To: Elizabeth Franklin (USACE)

From: AmyMarie Accardi-Dey (WSP)
Len Warner (WSP)

Date: January 13, 2021

RE: 2008 Oversight of the CPG Sediment Coring Program

The purpose of this memorandum is to transmit documentation summarizing government field oversight of the 2008 Sediment Coring Program conducted by the Cooperating Parties Group (CPG) on the Lower Passaic River for the Remedial Investigation / Feasibility Study (RI/FS) of Operable Unit (OU4) of the Diamond Alkali Superfund Site. Field oversight was conducted by Malcolm Pirnie, Inc. (MPI) on behalf of the United States Army Corps of Engineers – Kansas City District (USACE) and the United States Environmental Protection Agency (EPA). Oversight documentation includes the following attachments and deliverables, which are attached to this memorandum:

Attachment A: Malcolm Pirnie, Inc. Oversight Forms. Field oversight covered both sediment probing and sediment coring activities. Sediment probing activities were conducted by CPG prior to sediment core collection to estimate core penetration depths in areas where coring had not been previously attempted. Oversight of sediment probing consisted of one day of field work on July 25, 2008. Sediment coring activities were conducted by CPG from July 30 to December 16, 2008 and consisted of 69 workdays in total. Oversight was conducted on eleven days (covering 16 percent of the CPG field work). Oversight was "front-loaded" to the earlier portion of the field work, occurring between July 30 and September 25, 2008.

Attachment B: Progress Memorandum to EPA and USACE on Initial Observation of CPG Sediment Coring Program (dated August 12, 2008). After four days of oversight observations, a progress memorandum was provided to EPA and USACE. With one exception (which was corrected in the field), field work was being implemented according to the approved work plan and standard operating procedures. Field observations requiring further discussion with the CPG, which were raised in the memorandum, were resolved as follows:

1. Use of wire to divide core segments. A concern was raised in the memorandum that the use of a wire to divide core segments could result in a top-to-bottom smear zone down the center of the core segment or disturb and 'drag' coarse-grained materials across core segment boundaries. The CPG submitted Field Modification Form FM-080823-1 (effective date September 3, 2008) to address the concern and required the use of wide blade, stainless steel spatula(s) to separate core segments, specifically when the core included more than one sampling interval.
2. Use of core catchers. It was recommended that use of core catchers be discontinued in areas with cohesive sediments. The CPG's consultant ENSR committed to attempt to collect sediment data without a core catcher (two attempts) when working in previously uncharacterized areas.

Attachment C: Malcolm Pirnie, Inc. Quality Assurance Field Audit Report on 2008 Split Sample Collection (dated September 24, 2008). Throughout the CPG sediment coring program, oversight staff collected government split samples on behalf of EPA and USACE. Government split samples were collected from 4 percent of the CPG samples, yielding 30 split samples plus two field duplicates. Split samples were collected and shipped in 17 separate events between August 5 and December 9, 2008. A field audit was conducted on September 24, 2008 to confirm that split samples were being generated according to the Oversight Quality Assurance Project Plan and is documented on the attached form.

Attachment D: Malcolm Pirnie, Inc. Split Sample Comparison of 2008 CPG Sediment Coring Data (dated October 5, 2009). Split sample analytical results provided an independent analytical dataset that was compared to the CPG's sample results to investigate precision, accuracy, and potential bias. The split sample comparison showed

616865

significant and substantial biases between the government and CPG datasets for the polychlorodibenzodioxin/furan (PCDD/F) congeners, total organic carbon (TOC), and polycyclic aromatic hydrocarbons (PAH), except for Anthracene, as documented in this report.

Attachment E: Independent Investigation Reports (prepared by CSC Environmental Solutions and Interface, Inc., dated March 16, 2010 and January 2011). In response to the observed PCDD/F split sample analytical result discrepancy reported by MPI (refer to Attachment D), an independent investigation was contracted by EPA and completed to review the CPG data generated by Columbia Analytical Services (CAS) and the government split sample data generated by AXYS Analytical Services (AXYS). The conclusion of the investigation was that the PCDD/F data generated by CAS was biased low by approximately a factor of 0.5. The investigation provided a "correction factor" to adjust the CAS PCDD/F values, assuming that the AXYS split data represented the true value, as documented in the two reports.

Attachment A

Malcolm Pirnie, Inc. Oversight Forms

Total # of pages: 2

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

SEDIMENT PROBING

Probe/Core Designation:	Target Location:	Date:
2008 - CLRC - 08	Northing: 597321 Easting: 737374	7/25/2008 Time: 1350

Name(s) of Contractor Samplers (Include Boat Captain Name):
JOHN ROLFE - DE MAXIMUS
JEFF HOLZER - ENSR DON BOYE - ENSR

Sampling locations agree with those specified in the QAPP/FSP:
☑ Yes ☐ No WITHIN APPROX. 5' OF TARGET LOCATION

Was the probe equipment properly rinsed between attempts?
☐ Yes ☐ No ☑ n/a
Comment:

Was the probe advanced using appropriate force:
Yes No
Comment:
CREW HAD 10' PROBE ROD, WATER TOO DEEP TO PROBE.

Sediment Probe Attempt Chart
TSI Probe ID #: _____

Probe Attempts	Northing	Easting	Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Penetration Depth (ft):	Other Observations:

LPRRP-02-Sediment Probing

Total # of pages: 2

Additional comments on sediment probing operations (if necessary): BOAT NOT ANCHORED DURING PROBING ACTIVITIES.	
Malcolm Pirnie Inc Oversight Staff's Name (printed): DOUGLAS ALLEN	
Oversight Staff's Signature	Date: 7/25/2008

Total # of pages: 2

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

SEDIMENT PROBING

Probe/Core Designation:	Target Location:	Date:
2008 - CLRC - 082	Northing: 737355 Easting: 597457	7/25/2008 Time: 1344

Name(s) of Contractor Samplers (Include Boat Captain Name):
John Roffe - Dexmaxmus
Jeff Holzer - Ensr Don Boyle - Ensr

Sampling locations agree with those specified in the QAPP/FSP:
☑ Yes ☐ No WITHIN APPROX. 5' OF TARGET LOCATION

Was the probe equipment properly rinsed between attempts?
☐ Yes ☐ No ☑ n/a
Comment:

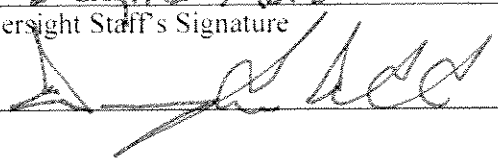
Was the probe advanced using appropriate force:
Yes No
Comment: CREW HAD 10' PROBE ROD. WATER TOO DEEP TO PROBE

Sediment Probe Attempt Chart
TSI Probe ID #:

Probe Attempts	Northing	Easting	Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Penetration Depth (ft):	Other Observations:

LPRRP-02-Sediment Probing

Total # of pages: 2

Additional comments on sediment probing operations (if necessary):
BOAT NOT ANCHORED ON TARGET LOCATION.
Malcolm Pirnie Inc Oversight Staff's Name (printed): DOUGLAS AULD
Oversight Staff's Signature  Date: 7/25/2008

Total # of pages: 2

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

SEDIMENT PROBING

Probe/Core Designation:	Target Location:	Date:
2008-ARL-083	Northing: 737973 Easting: 597459	7/25/2008 Time: 1340

Name(s) of Contractor Samplers (Include Boat Captain Name):
JOHN ROLFE - DETRAKIMUS
JEFF HOLZER - ENSR. DON BOYE - ENSR

Sampling locations agree with those specified in the QAPP/FSP:
☑ Yes ☐ No WITHIN APPROX. 5' OF TARGET LOCATION

Was the probe equipment properly rinsed between attempts?
☐ Yes ☐ No ☑ n/a
Comment:

Was the probe advanced using appropriate force:
Yes No
Comment:
CREW HAD 10' PROBE, WATER TOO DEEP

Sediment Probe Attempt Chart
TSI Probe ID #:

Probe Attempts	Northing	Easting	Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Penetration Depth (ft):	Other Observations:

LPRRP-02-Sediment Probing

Total # of pages: 2

Additional comments on sediment probing operations (if necessary): BOAT NOT ANCHORED DURING PROBING ACTIVITIES.	
Malcolm Pirnie Inc Oversight Staff's Name (printed): DOUGLAS AULD	
Oversight Staff's Signature:	Date: 7/25/2008

Total # of pages: 2

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

SEDIMENT PROBING

Probe/Core Designation:	Target Location:	Date:
2008-CLRC-084	Northing: 737988 Easting: 597562	7/25/2008 Time: 1333

Name(s) of Contractor Samplers (Include Boat Captain Name):
JOHN ROTE - DEMAXIMIS
JEFF HOLZER - EHSR. DON BOYE - EHSR.

Sampling locations agree with those specified in the QAPP/FSP: WITHIN APPROX. 5' OF TARGET LOCATION
☑ Yes ☐ No

Was the probe equipment properly rinsed between attempts?
☑ Yes ☐ No ☐ n/a
Comment:

Was the probe advanced using appropriate force:
☑ Yes ☐ No
Comment:

Sediment Probe Attempt Chart
TSI Probe ID #:

Probe Attempts	Northing	Easting	Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Penetration Depth (ft):	Other Observations:
1	RECORDED BY CPG, BUT NOT PROVIDED			8'	APPROX 3'	SILT	2'	SOFT TO DEPTH GREATER THAN 2', BUT LIMITED DUE TO PROBE ROD LENGTH.

LPRRP-02-Sediment Probing

Total # of pages: 2

Additional comments on sediment probing operations (if necessary):
BOAT NOT ANCHORED DURING PROBING ACTIVITIES. COORDINATES REPORTED BY CPG AS BEING STEERED/RECORDED ON PORTABLE GPS UNIT. OVERSIGHT PERSONNEL TOLD THAT TARGET LOCATIONS LISTED IN QAPP, COORDINATES OF TARGET PROBE ATTEMPTS NOT PROVIDED.
Malcolm Pirnie Inc Oversight Staff's Name (printed): DOUGLAS ARLO
Oversight Staff's Signature: [signature] / Date: 7/25/2008

Total # of pages: 2

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

SEDIMENT PROBING

Probe/Core Designation:	Target Location:	Date:
2008-CLRC-085	Northing: 736942 Easting: 599480	7/25/2008 Time: 1130

Name(s) of Contractor Samplers (Include Boat Captain Name):
JOHN ROLFE - DEMAXIMUS
JEFF HOLZER - ENSR DON BOYE - ENSR

Sampling locations agree with those specified in the QAPP/FSP:
☑ Yes ☐ No WITHIN APPROX. 5' OF TARGET LOCATION

Was the probe equipment properly rinsed between attempts?
☑ Yes ☐ No ☐ n/a
Comment:

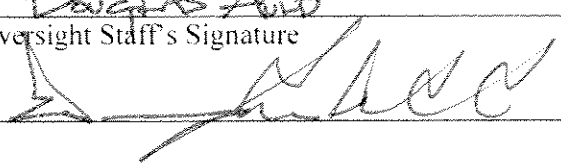
Was the probe advanced using appropriate force:
☑ Yes ☐ No
Comment:

Sediment Probe Attempt Chart
TSI Probe ID #:

Probe Attempts	Northing	Easting	Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Penetration Depth (ft):	Other Observations:
1	RECORDED BY CPG BUT NOT PROVIDED		—	45'	APPROX 3'	SILT-GRAVEL	5.5'	SILT FOLLOWED BY GRAVEL.
2	"	"	—	46'	"	SILT-SAND	5.5'	4'< "SOFT" POSSIBLY SILT
3	"	"	—	46'	"	SILT-SAND/GRAVEL	4'	4'< SANDY SILT.

LPRRP-02-Sediment Probing

Total # of pages: 2

Additional comments on sediment probing operations (if necessary):
BOAT NOT ANCHORED DURING PROBING ATTEMPTS. PROBE ATTEMPT COORDINATES NOT PROVIDED.
Malcolm Pirnie Inc Oversight Staff's Name (printed): DOUGLAS ALLO
Oversight Staff's Signature  Date: 7/25/2008

Total # of pages: 2

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

SEDIMENT PROBING

Probe/Core Designation:	Target Location:	Date:
2008-CLRC-0806	Northing: 737112 Easting: 600476	7/25/2008 Time: 1155

Name(s) of Contractor Samplers (Include Boat Captain Name):
JOHN RUFFO - DEMAXIMUS
JEFF HOLZER - ENSR DON BOYE - ENSR

Sampling locations agree with those specified in the QAPP/FSP:
WITHIN APPROX. 5' OF TARGET LOCATION
☑ Yes ☐ No

Was the probe equipment properly rinsed between attempts?
☑ Yes ☐ No ☐ n/a
Comment:

Was the probe advanced using appropriate force:
Yes No
Comment:

Sediment Probe Attempt Chart
TSI Probe ID #:

Probe Attempts	Northing	Easting	Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Penetration Depth (ft):	Other Observations:
1	RECORDED BY CPG BUT NOT PROVIDED			8'	APPROX 3'	COARSE SAND	1.5'	BELOW 4 TO 12" OF COARSE SAND IS SOFTER LAYER
2	"	"		9'	" "	COARSE SAND	0.5'	N/A

LPRRP-02-Sediment Probing

Total # of pages: 2

Additional comments on sediment probing operations (if necessary): BOAT NOT ANCHORED DURING PROBING ACTIVITIES. COORDINATES FOR PROBE ATTEMPTS NOT PROVIDED.	
Malcolm Pirnie Inc Oversight Staff's Name (printed): DOUGLAS ALLEN	
Oversight Staff's Signature	Date: 7/25/2008

LPRRP-02-Sediment Probing

Total # of pages: 2

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

SEDIMENT PROBING

Probe/Core Designation:	Target Location:	Date:
2008-CARC-087	Northing: 737046 Easting: 600623	7/25/2008 Time: 1205

Name(s) of Contractor Samplers (Include Boat Captain Name):
John Rolfe - Dermaximus
Jeff Holzer - Ensr Dan Boyle - Ensr

Sampling locations agree with those specified in the QAPP/FSP: Within Approx. 5' of Target location
☑ Yes ☐ No

Was the probe equipment properly rinsed between attempts?
☑ Yes ☐ No ☐ n/a
Comment:

Was the probe advanced using appropriate force:
☑ Yes ☐ No
Comment:

Sediment Probe Attempt Chart
TSI Probe ID #:

Probe Attempts	Northing	Easting	Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Penetration Depth (ft):	Other Observations:
1	Recorded but not provided	By CPG		5.5'	Approx 3'	M-C sand	2'	N/A
2	"	"		8.5'	" "	Silty sand	2'	Silty sand to 4'6" followed by sand
3	"	"		6'	" "	Silt - F. sand	4'	N/A

LPRRP-02-Sediment Probing

Total # of pages: 2

Additional comments on sediment probing operations (if necessary): BOAT NOT ANCHORED DURING PROBING OPERATIONS. COORDINATES FOR PROBE ATTEMPTS NOT PROVIDED.	
Malcolm Pirnie Inc Oversight Staff's Name (printed): DOUGLAS AULD	
Oversight Staff's Signature	Date: 7/25/2008

Total # of pages: _____

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

SEDIMENT PROBING

Probe/Core Designation:	Target Location:	Date:
LOCATION # 88	Northing: 739256 Easting: 600699	JULY 25, 2008 Time: 12:18 P.M.

Name(s) of Contractor Samplers (Include Boat Captain Name):
JOHN ROLFE
JEFF HOLZER - DON BOYE

Sampling locations agree with those specified in the QAPP/FSP:
✓ Yes No WITHIN APPROX. 10' OF TARGET LOCATION

Was the probe equipment properly rinsed between attempts?
✓ Yes No n/a
Comment:

Was the probe advanced using the techniques described in the SOP (two-handed technique, hands held close to chest, probe advanced robustly):
✓ Yes No
Comment:

Sediment Probe Chart
CPG Probe ID #:

Probe Attempts	Northing	Easting	Penetration Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Other Observations:
1	RECORDED BY CPG BUT NOT PROVIDED	"	✓ 0.5'	6'	✓ 3'	SAND & GRAVEL	HARD AT ✓ 7' BELOW WATER
2	"	"	✓ 1.5'	4.5'	✓ 3'	SAND & GRAVEL	N/A

LPRRP-02-Sediment Probing

Total # of pages: _____

Sediment Probe Chart
CPG Probe ID #: _____

Probe Attempts	Northing	Easting	Penetration Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Other Observations:

Additional comments on sediment probing operations (if necessary):

BOAT NOT ANCHORED DURING SEDIMENT PROBING ACTIVITIES

Malcolm Pirnie Inc. Oversight Staff's Name (printed):

Douglas Auld

Oversight Staff's Signature

Date: 7/25/2008

Total # of pages: _____

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

SEDIMENT PROBING

Probe/Core Designation:	Target Location:	Date:
Location # 89	Northing: 739285 Easting: 600860	July 25, 2008 Time: 12:25 P.M.

Name(s) of Contractor Samplers (Include Boat Captain Name):
JOHN ROLFE
JEFF HOWSER — DON BOYE

Sampling locations agree with those specified in the QAPP/FSP:
✓ Yes No WITHIN APPROX. 5' OF TARGET LOCATION

Was the probe equipment properly rinsed between attempts?
✓ Yes No n/a
Comment:

Was the probe advanced using the techniques described in the SOP (two-handed technique, hands held close to chest, probe advanced robustly):
✓ Yes No
Comment:

Sediment Probe Chart
CPG Probe ID #: _____

Probe Attempts	Northing	Easting	Penetration Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Other Observations:
1	RECORDED BY CREW BUT NOT PROVIDED		✓ 3'	4.5'	✓ 3'	COARSE SAND	HARD AT ✓ 7.5'
2			✓ 3.5	3.5	✓ 3'	COARSE SAND	HARD AT ✓ 7'-7.5'

LPRRP-02-Sediment Probing

Total # of pages: _____

Sediment Probe Chart

CPG Probe ID #: _____

Probe Attempts	Northing	Easting	Penetration Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Other Observations:

Additional comments on sediment probing operations (if necessary):

BOAT NOT ANCHORED DURING PROBING ACTIVITIES

Malcolm Pirnie Inc. Oversight Staff's Name (printed):

DOUGLAS AUNG

Oversight Staff's Signature:

Date:

7/25/2008

Total # of pages: _____

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

SEDIMENT PROBING

Probe/Core Designation:	Target Location:	Date:
LOCATION #90 2008-CLRC-090	Northing: 739764 Easting: 600361	JULY 25, 2008 Time: 12:35 P.M.

Name(s) of Contractor Samplers (Include Boat Captain Name):
JOHN BOLFE
JEFF HOLBEK – DON BOYE

Sampling locations agree with those specified in the QAPP/FSP:
✓ Yes No WITHIN APPROX. 10' OF TARGET LOCATION

Was the probe equipment properly rinsed between attempts?
✓ Yes No n/a
Comment:

Was the probe advanced using the techniques described in the SOP (two-handed technique, hands held close to chest, probe advanced robustly):
✓ Yes No
Comment:

Sediment Probe Chart
CPG Probe ID #: _____

Probe Attempts	Northing	Easting	Penetration Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Other Observations:
1	RECORDED BY CPG BUT NOT PROVIDED		✓ 1'	4'	✓ 3'	COARSE SAND & GRAVEL	
2			✓ 1'	4'	✓ 3'	COARSE SAND & GRAVEL	HARD AT ~5'

LPRRP-02-Sediment Probing

Total # of pages: _____

Sediment Probe Chart
CPG Probe ID #:

Probe Attempts	Northing	Easting	Penetration Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Other Observations:

Additional comments on sediment probing operations (if necessary):

BOAT NOT ANCHORED

Malcolm Pirnie Inc. Oversight Staff's Name (printed):

Douglas Arno

Oversight Staff's Signature

Date:

7/25/2000

Total # of pages: _____

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

SEDIMENT PROBING

Probe/Core Designation:	Target Location:	Date:
LOCATION # 91	Northing: 741319 Easting: 599354	JULY 25, 2008 Time: 12:50 P.M.

Name(s) of Contractor Samplers (Include Boat Captain Name):
JOHN ROLFE
JEFF HOLZER - DOIN BOYE

Sampling locations agree with those specified in the QAPP/FSP:
✓ Yes No WITHIN APPROX. 5' OF TARGET LOCATION

Was the probe equipment properly rinsed between attempts?
✓ Yes No n/a
Comment:

Was the probe advanced using the techniques described in the SOP (two-handed technique, hands held close to chest, probe advanced robustly):
✓ Yes No
Comment:

Sediment Probe Chart
CPG Probe ID #:

Probe Attempts	Northing	Easting	Penetration Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Other Observations:
1	RECORDED BY CPG NOT PROVIDED		~ 1'	4.5'	~ 3'	GRAVEL AND ROCK	
2			0.5'	4.5'	~ 3'	GRAVEL AND ROCK	

LPRRP-02-Sediment Probing

Total # of pages: _____

Sediment Probe Chart
CPG Probe ID #: _____

Probe Attempts	Northing	Easting	Penetration Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Other Observations:

Additional comments on sediment probing operations (if necessary):

BOAT NOT ANCHORED

Malcolm Pirnie Inc. Oversight Staff's Name (printed):

DOUGLAS AUD

Oversight Staff's Signature

Date:

7/25/2008

Total # of pages: _____

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

SEDIMENT PROBING

Probe/Core Designation:	Target Location:	Date:
Location # 92	Northing: 741319 Easting: 599354	July 25, 2008 Time: 12:58 P.M

Name(s) of Contractor Samplers (Include Boat Captain Name):
JOHN ~~BOLPE~~
JEFF HOLZER – DON BOYE

Sampling locations agree with those specified in the QAPP/FSP:
✓ Yes No

Was the probe equipment properly rinsed between attempts?
✓ Yes No n/a
Comment:

Was the probe advanced using the techniques described in the SOP (two-handed technique, hands held close to chest, probe advanced robustly):
✓ Yes No
Comment:

Sediment Probe Chart
CPG Probe ID #:

Probe Attempts	Northing	Easting	Penetration Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Other Observations:
1	RECORDED BY CPG NOT PROVIDED		<0.3'	6'	✓ 3'	ROCK & SOME SAND	
2			<0.3'	6'	✓ 25'	ROCK	

LPRRP-02-Sediment Probing

Total # of pages: _____

Sediment Probe Chart
CPG Probe ID #:

Probe Attempts	Northing	Easting	Penetration Depth (ft):	Water Depth (ft):	Offset:	Sediment Type:	Other Observations:

Additional comments on sediment probing operations (if necessary):

BOAT NOT ANCHORED.

Malcolm Pirnie Inc. Oversight Staff's Name (printed):

Richard Amo

Oversight Staff's Signature

Date: 7/25/2008

Total # of pages: 1/7

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date: 7/30/08
ϕϕ47-C1	Northing: 706609 Easting: 587931	Time: 0900 on loc.

Name(s) of Contractor Samplers (Include Boat Captain Name):
OSE: Dave Kowalsky; Steve Gadinski
ENSR: Don Boye; Mike Hauser; Jeff Holzer

Necessary information (specified in core collection SOP) recorded into the field notebook: ☒ Yes ☐ No (comment:)	Sampling locations agree with those specified in the QAPP/FSP: ☒ Yes ☐ No
Core advanced via: ☐ Pushing (piston/hand) ☒ Vibracore ☐ Other (comment):	Was the core tubing rinsed thoroughly between attempts? ☐ Yes ☐ No ☒ n/a
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ☒ Yes ☐ No	Was a core catcher used? If so, why? ☒ Yes ☐ No To achieve sufficient recovery
Were multiple attempts made to advance the core? ☐ Yes ☒ No Comment:	Was a short core collected? ☐ Yes ☒ No
	Short Core Designation: Northing: Easting: Offset from Target:

LPRRP-03a-Core Sampling

Total # of pages: 2/7

Core Attempt Chart

CPG Core ID #: 0047-C1

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (in)	Recovery Depth (in)	Recovery %	Disposition of attempt*
Final C1	706607.08	587833.66		3 5/8"	core	PVC	7.85'	8'	98%	F

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

☒ Core Labeled ☒ Core Sealed ☒ Marked with "Up" ☒ Stored (iced, under tarp)

Deviations: NONE NOTED

Correct decontamination procedures performed for field equipment (if applicable): N/A

☐ Proper decontamination solutions used ☐ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DAVID S. FOSTER

Oversight Staff's Signature: David Foster

Date: 7/30/08

Total # of pages: 3/7

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date: 7/30/08
ØØ47C4	Northing: 706609 Easting: 587931	Time: 1035 ~~0900~~ arrive @ Loc.

Name(s) of Contractor Samplers (Include Boat Captain Name):
OSI: Capt Dave Kowalsky; Steve Gadomski
ENSR: Don Boye; Mike Hauser; Jeff Holzer

Necessary information (specified in core collection SOP) recorded into the field notebook:
☒ Yes ☐ No (comment:)

Sampling locations agree with those specified in the QAPP/FSP:
☒ Yes ☐ No

Core advanced via:
☒ Pushing (piston/hand) ☒ Vibracore
☐ Other (comment):

Was the core tubing rinsed thoroughly between attempts?
☒ Yes ☐ No ☐ n/a

Was the vibracore motor turned on immediately after the core tube penetrated the sediment?
☒ Yes ☐ No

Was a core catcher used? If so, why?
☒ Yes ☐ No
Driller did not believe recovery could be achieved I suggested trying next time.

Were multiple attempts made to advance the core?
☒ Yes ☐ No Comment:

(C2) First Attempt was advanced by hand - insufficient recovery

(C3) 2nd Attempt Driller Failed to let core sit 10 min. (reject)

(C4) Good.

Was a short core collected?
☒ Yes ☐ No

Short Core Designation: ØØ47C4

Northing: 706604.64

Easting: 587826.16

Offset from Target:

LPRRP-03a-Core Sampling

Total # of pages: 4/7

Core Attempt Chart

CPG Core ID #: 0047-C4

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (in)	Recovery Depth (in)	Recovery %	Disposition of attempt*
C2	706602.80	587833.40		3 5/8"	core	lexan	4.5		<80%	D
C3	706602.80	587833.40		3 5/8"	core	↓	4.5		>80%	D
~~C4~~ DP										
Final C4	706604.64	587826.16		3 5/8"	core	lexan	4.5'	4.6'	100%	F

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

X Core Labeled X Core Sealed X Marked with "Up" X Stored (iced, under tarp)

Deviations: NONE NOTED

Correct decontamination procedures performed for field equipment (if applicable):

X Proper decontamination solutions used ☐ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

C4 - discard bottom 6" (silty)

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DAVID S. FOSTER

Oversight Staff's Signature

Date: 7/30/08

LPRRP-03b-Grab Sampling

Total # of pages: 5/7

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

GRAB SAMPLING

Sediment Grab Designation:	Target Sediment Grab Location: Northing: Easting:	Date: 7/30/08 Time:

Name(s) of Contractor Samplers (Include Boat Captain Name):
Capt Dave Kowalsky; Steve Gadomski (OSI)
Don Boye; Mike Hauser; Jeff Holzer (ENSR)

Necessary information (specified in grab collection SOP) recorded into the field notebooks:
☐ Yes ☐ No (comment:)

Sampling locations agree with those specified in the QAPP/FSP?
☐ Yes ☐ No

Identify the type of grab sampler used (*e.g.*, ponar dredge, van veen sampler, or box corer):
NO GRAB SAMPLES OBS'V'D

Was the sampler rinsed properly between multiple grab attempts at the same location?
☐ Yes ☐ No ☐ n/a Comment:

Grab Attempt Chart

CPG Grab ID #: _____

Grab Attempts	Northing	Easting	Offset (ft)	Sample Type (grab/field blank)	Disposition of attempt*	Other Observations
Final						

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Total # of pages: 6/7

Confirm grab sample labeling and handling by checking appropriate boxes below:

☐ Top 1-inch layer removed for Be-7 analysis ☐ Remaining sample homogenized

☐ VOC collected ☐ Sample jars stored on ice

Deviations/Comments:

Correct decontamination procedures performed for field equipment (if applicable):

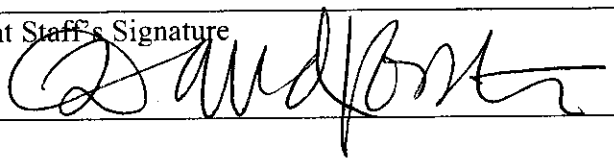
☐ Proper decontamination solutions used ☐ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

NO GRAB SAMPLES OBSERVED ON THIS DATE (7/30/08)

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DAVID S. FOSTER

Oversight Staff's Signature	Date:
	7/30/08

Total # of pages: 7/7

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

DECONTAMINATION (ONBOARD BOAT OR AT PROCESSING FACILITY)

DECON PROCEDURES SHOULD BE DOCUMENTED TWICE PER WEEK FOR BOTH ONBOARD AND ONSHORE SAMPLING ACTIVITIES.

Were all of the following steps performed in the correct order:

☐ Yes ☒ No (comment:) N/A

☐ washed with laboratory grade detergent
☐ rinsed with distilled water
☐ rinsed with acetone, then allowed to air dry
☐ rinsed with hexane, then allowed to air dry
☐ rinsed with distilled water

Location:
☐ lab ☒ boat

Time: 1135

Names of technicians:
Steve Gadomski (OSI)
Dave Kowalsky (OSI)

Equipment type:
☐ Laboratory equipment
☐ Ponar dredge (or other grab sampler)
☒ Boat equipment

Rinsate collected and disposed of in the appropriate containers:

☐ Yes ☒ No (comment:) N/A

Decontamination steps involving acetone and hexane were performed under hoods (applies only to processing facility):

☐ Yes ☒ No (comment:) N/A (on boat)

Additional comments on the equipment decontamination process (if necessary):

Rinse w/river water between attempts C2; C3; C4.

Malcolm Pirnie Inc Oversight Staff Name (printed):

DAVID S. FOSTER

Oversight Staff's Signature: David Foster

Date: 7/30/08

Total # of pages: 1

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

DECONTAMINATION (ONBOARD BOAT OR AT PROCESSING FACILITY)

DECON PROCEDURES SHOULD BE DOCUMENTED TWICE PER WEEK FOR BOTH ONBOARD AND ONSHORE SAMPLING ACTIVITIES.

Were all of the following steps performed in the correct order:

Yes ☑ No (comment:)

- ☐ washed with laboratory grade detergent
- ☐ rinsed with distilled water
- ☐ rinsed with acetone, then allowed to air dry
- ☐ rinsed with hexane, then allowed to air dry
- ☐ rinsed with distilled water

CPG REPORTS THAT HEXAN TUBES DECONED IN FIELD FACILITY. CORE BARRELL & PONAR DREDGE RINSED WITH RIVER WATER

Location:
☐ lab ☑ boat

Time:
0700 - 1300

Names of technicians:
AL MODJESKI - ENSR
JEFF HOLZER - ENSR
MIKE HAUSER - ENSR

Equipment type:
☐ Laboratory equipment
☑ Ponar dredge (or other grab sampler)
☑ Boat equipment

Rinsate collected and disposed of in the appropriate containers:

☐ Yes ☑ No (comment:)
NO SOLVENTS / DETERGENT WAS USED ON THE CORING VESSEL

Decontamination steps involving acetone and hexane were performed under hoods (applies only to processing facility):

☐ Yes ☐ No (comment:)

Additional comments on the equipment decontamination process (if necessary):

CPG REPORTS THAT ALL EQUIPMENT REQUIRING DECONTAMINATION WILL BE DECONTAMINATED IN THE FIELD FACILITY. VIBRA-CORE CORE BARREL, PONAR DREDGE AND VESSEL EQUIPMENT CLEANED BY RINSE WITH RIVER WATER.

Malcolm Pirnie Inc Oversight Staff Name (printed):

DOUGLAS AULD

Oversight Staff's Signature: [signature]

Date: 8/4/2008

Total # of pages: 2

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

GRAB SAMPLING

Sediment Grab Designation:	Target Sediment Grab Location:	Date:
2008-CLRC-057	Northing: 713659.00 Easting: 591108.00	8/4/2008 Time: APPROX. 10:25 - 10:50

Name(s) of Contractor Samplers (Include Boat Captain Name): OCEAN SURVEY, INC: DAVE KOWALSKI (CAPTAIN) STEVE GRODOMSKI (MATE) AL MODJOSKI - ENSR JEFF HOLZER - ENSR MIKE HAUSER - ENSR

Necessary information (specified in grab collection SOP) recorded into the field notebooks: ☑ Yes ☐ No (comment:)

Sampling locations agree with those specified in the QAPP/FSP? ☑ Yes ☐ No

Identify the type of grab sampler used (*e.g.*, ponar dredge, van veen sampler, or box corer): PONAR DREDGE W/ STABILIZATION FRAME

Was the sampler rinsed properly between multiple grab attempts at the same location? ☐ Yes ☐ No ☑ n/a Comment: THE SAMPLER WAS PROPERLY RINSED, BUT THERE WERE NOT MULTIPLE ATTEMPTS PER SAMPLE.

Grab Attempt Chart

TSI Grab ID #:

Grab Attempts	Northing	Easting	Offset (ft)	Sample Type (grab/field blank)	Disposition of attempt*	Other Observations
G-1	713653.44	591112.19	10.910	PONAR GRAB	F	GRAB SAMPLE #1. SAVED
G-2	713653.34	591108.04	—	PONAR GRAB	F	GRAB SAMPLE #2. SAVED
Final						

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

LPRRP-03b-Grab Sampling

Total # of pages: 2

Confirm grab sample labeling and handling by checking appropriate boxes below:

✓ Top 1-inch layer removed for Be-7 analysis ✓ Remaining sample homogenized

✓ VOC collected ✓ Sample jars stored on ice

Deviations/Comments: NONE NOTED

Correct decontamination procedures performed for field equipment (if applicable):

Proper decontamination solutions used Decontamination waste collected for proper disposal

FIELD EQUIPMENT WAS ONLY RINSED WITH TAP WATER.

Additional comments on sampling operations (if necessary):

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS AULD

Oversight Staff's Signature	Date:
	8/4/2008

Total # of pages: 2

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008-CLRC-057	Northing: 713659.80 Easting: 591108.00	8/4/2008 Time: APPROX. 0815-1015

Name(s) of Contractor Samplers (Include Boat Captain Name): AL MODJESKI - ENSR, JEFF HOLZER - ENSR, MIKE HAUSER - ENSR, OCEAN SURVEY, INC. DAVE KOWALSKI (CAPTAIN), STEVE GADOMSKI (MATE)

Necessary information (specified in core collection SOP) recorded into the field notebook: ☑ Yes ☐ No (comment:)	Sampling locations agree with those specified in the QAPP/FSP: ☑ Yes ☐ No
Core advanced via: ☐ Pushing (piston/hand) ☑ Vibracore ☐ Other (comment):	Was the core tubing rinsed thoroughly between attempts? ☐ Yes ☐ No ☑ n/a ONLY ONE ATTEMPT WAS MADE FOR EACH CORE.
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ☑ Yes ☐ No	Was a core catcher used? If so, why? ☐ Yes ☑ No CORE BARREL ALLOWED TO SIT FOR 10-MIN. PRIOR TO EXTRACTION.
Were multiple attempts made to advance the core? ☑ Yes ☐ No Comment:	Was a short core collected? ☐ Yes ☑ No
	Short Core Designation: Northing: Easting: Offset from Target:

LPRRP-03a-Core Sampling

Total # of pages: 2

Core Attempt Chart

TSI Core ID #:

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (ft) (FT.)	Recovery Depth (ft) (FT.)	Recovery %	Disposition of attempt*
1	713658.34	591107.37	0.91	3 5/8"	CORE	LEXAN	9.8'	8.45'	86	F
2	713657.85	591111.85	4.02	3 5/8"	CORE	LEXAN	9.8'	9.1'	93	F
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

☑ Core Labeled ☑ Core Sealed ☑ Marked with "Up" ☑ Stored (iced, under tarp)

Deviations: APPROX. 2" OF SAND FELL OUT OF CORE BOTTOM UPON RETRIEVAL.

Correct decontamination procedures performed for field equipment (if applicable):

☐ Proper decontamination solutions used ☐ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

- EXCESS WATER DRAINED FROM TOP OF CORE BY DRILLING HOLES THROUGH LEXAN IN APPROX. 2" SEGMENTS.
- CORE CUT INTO 2 SECTIONS FOR TRANSPORTATION.

SECTION #1 - 4' OF BLACK SILT
SECTION #2 - 4' OF BLACK SILT, APPROX. 0.45 OF RED-BROWN SAND. } C1

SECTION #1 - 4.5' BLACK SILT / SECTION #2 - 4' SILT - 0.5' SAND } C2

Malcolm Pirnie Inc Oversight Staff's Name (printed):

Douglas Auld

Oversight Staff's Signature

Date: 8/4/2008

Total # of pages: 4 of 10

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

GRAB SAMPLING

Sediment Grab Designation:	Target Sediment Grab Location:	Date:
2008 - CURL - 049	Northing: 708327.00 Easting: 589179.00	8/6/2008 Time: 0915

Name(s) of Contractor Samplers (Include Boat Captain Name): JEFF HOWZER - FENSER, MIKE HAUSER - FENSER, DON BOYD - FENSER
OCEAN SURVEYS, INC. DANIEL KOWALSKI - CAPTN. STEVE GRODZINSKI - MATE

Necessary information (specified in grab collection SOP) recorded into the field notebooks:
☑ Yes ☐ No (comment:)

Sampling locations agree with those specified in the QAPP/FSP?
☑ Yes ☐ No

Identify the type of grab sampler used (*e.g.*, ponar dredge, van veen sampler, or box corer):

PONAR DREDGE (12"X12") W/ STABILIZATION FRAME

Was the sampler rinsed properly between multiple grab attempts at the same location?
☑ Yes ☐ No ☐ n/a Comment:

Grab Attempt Chart

TSI Grab ID #:

Grab Attempts	Northing	Easting	Offset (ft)	Sample Type (grab/field blank)	Disposition of attempt*	Other Observations
G1	22.63 708323.83	79.03 589187.39	4.37 0.95	PONAR GRAB	F	
G2	27.00 708314.51	79.35 589190.42	4.37	PONAR GRAB	D	
G3	708329.31	589183.60	3.15	PONAR GRAB	F	
Final						

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

LPRRP-03b-Grab Sampling

Total # of pages: 2 of 6

Confirm grab sample labeling and handling by checking appropriate boxes below:

✓ Top 1-inch layer removed for Be-7 analysis ✓ Remaining sample homogenized

✓ VOC collected* ✓ Sample jars stored on ice

Deviations/Comments:

Correct decontamination procedures performed for field equipment (if applicable):

Proper decontamination solutions used Decontamination waste collected for proper disposal

NO DECONTAMINATION PERFORMED ON VESSEL OTHER THAN RINSING DREDGE W/ RIVER WATER BETWEEN GRAB SAMPLE COLLECTION.

Additional comments on sampling operations (if necessary):

G1 - SEDIMENTS APPEAR TO BE PRIMARILY F-C SAND W/ SMALL AMOUNTS OF ORGANIC DEBRIS.

G2 - ABANDONED

*G3 - VOC ONLY FROM THIS GRAB. SEDIMENTS APPEAR TO BE PRIMARILY F-C SAND.

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS AULD

Oversight Staff's Signature

Date: 8/6/2008

Total # of pages: 3 of 6

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008-CUEC-049	Northing: 708327.00 Easting: 589179.00	8/6/2008 Time: 0810-0845

Name(s) of Contractor Samplers (Include Boat Captain Name):
OCEAN SURVEY, INC. DAVE KOWALSKI - CAPTN.
STEVE GADOMSKI - MATE
JEFF HOLZER - ENSR
MIKE HAUSER - ENSR
DON BOYE - ENSR

Necessary information (specified in core collection SOP) recorded into the field notebook: ✓ Yes No (comment:)	Sampling locations agree with those specified in the QAPP/FSP: ✓ Yes No
Core advanced via: Pushing (piston/hand) ✓ Vibracore Other (comment):	Was the core tubing rinsed thoroughly between attempts? ✓ Yes No n/a
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ✓ Yes No FOR C2, DID NOT OBSERVE CIL (SEE NOTES)	Was a core catcher used? If so, why? ✓ Yes No 2 FAILED ATTEMPTS W/OUT. UNTIL CLARIFICATION, CORE CATCHER WILL BE USED PER ENSR
Were multiple attempts made to advance the core? Yes ✓ No Comment: 2 SEPARATE CORES COLLECTED AT THIS LOCATION. BOTH ENCOUNTER REFUSAL AT DEPTHS LESS THAN THREE PRESUMPTIVE TARGET PENETRATIONS OF 8' EACH.	Was a short core collected? ✓ Yes No Short Core Designation: (C-2) TARGET PEN - 8' CORE CATCHER UTILIZED Northing: 708325.45 Easting: 589193.05 Offset from Target: 4.34

LPRRP-03a-Core Sampling

Total # of pages: 4 of 6

Core Attempt Chart

TSI Core ID #:

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (in)	Recovery Depth (in)	Recovery %	Disposition of attempt*
(C1) 1	708328.47	589174.08	1.47	3 5/8"	CORE	LEX.	6.5'	4.15		F
(C2) 2	708325.45	589183.05	4.31	3 5/8"	CORE	LEX.	7.5'	6.5'	87	F
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

✓ Core Labeled ✓ Core Sealed ✓ Marked with "Up" ✓ Stored (iced, under tarp)

Deviations:

Correct decontamination procedures performed for field equipment (if applicable):

Proper decontamination solutions used Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

1) ARRIVED AT DOCK AT 0730 AS DIRECTED BY FENSE. DID NOT ARRIVE AT CORING LOCATION UNTIL 0810, AFTER COMPLETION OF INITIAL CORE. TARGET PENETRATION 8', REFUSAL AT 6.5'

SECT. # 1 - 3.65': BLACK FINE - COARSE SAND

SECT. # 2 - 0.5': DISCARD

2) C2 ADVANCED W/ CORE CATCHER. REFUSAL AT 7.5'

SECT. # 1 - 4' BLACK SAND

SECT. # 2 - 2.1' BLACK SAND - RED/BRN SANDY CLAY

0.4' DISCARD - RED/BRN SANDY CLAY

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS AUHO

Oversight Staff's Signature

Date: 8/10/2008

Total # of pages: 5 of 10

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008 - CLRC - 0100	Northing: 710442.00 Easting: 592488.00	8/6/2008 Time: 1049

Name(s) of Contractor Samplers (Include Boat Captain Name): OCEAN SURVEY, INC. DAVE KOWALSKI - CAPTN. STEVE GADOMSKI - MATE
JEFF HOLZER - ENSR, MIKE MAUSER - ENSR, DON BOYE - ENSR

Necessary information (specified in core collection SOP) recorded into the field notebook: ☑ Yes ☐ No (comment:)	Sampling locations agree with those specified in the QAPP/FSP: ☑ Yes ☐ No
Core advanced via: ☐ Pushing (piston/hand) ☑ Vibracore ☐ Other (comment):	Was the core tubing rinsed thoroughly between attempts? ☐ Yes ☐ No ☑ n/a NEW, DECONTAMINATED CORE LINER USED FOR EACH CORE
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ☑ Yes ☐ No	Was a core catcher used? If so, why? ☑ Yes ☐ No ENSR WILL USE CORE CATCHER UNTIL CLARIFICATION OF SOP IS OBTAINED FROM EPA
Were multiple attempts made to advance the core? ☐ Yes ☑ No Comment: ONE ATTEMPT WAS MADE TO COLLECT EACH CORE.	Was a short core collected? ☑ Yes ☐ No DUPLICATE CORE
	Short Core Designation: Northing: Easting: Offset from Target:

Total # of pages: 60 of 60

Core Attempt Chart

TSI Core ID #:

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (ft) FT.	Recovery Depth (ft) FT.	Recovery %	Disposition of attempt*
C1	7160439.49	592486.92	2.92	3 5/8"	core	LEX.	8.6'	8.7'		F
C2	7160441.12	592484.81	3.31	3 5/8"	core	LEX.	9.8'	9.8'	100	F
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

✓Core Labeled ✓Core Sealed ✓Marked with "Up" ✓Stored (iced, under tarp)

Deviations:

Correct decontamination procedures performed for field equipment (if applicable):

✓Proper decontamination solutions used ✓Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

C1 - TARGET PENETRATION IS 8', ACTUAL PENETRATION IS 8.6' CORE CUT INTO 2 SECTIONS FOR TRANSPORT BACK TO PROCESSING FACILITY. CORE CATCHER HAD TO BE CUT OFF BOTTOM OF CORE, BOTTOM APPROX. 4" OF MATERIAL LOST FROM TOTAL CORE.

C2 - TARGET PENETRATION IS 8' ACTUAL PENETRATION IS 9.8'. CORE CUT INTO 2 SECTIONS FOR TRANSPORT TO PROCESSING FACILITY.

DECON OF PONAR DREDGE PERFORMED USING SOLVENTS. SOLVENTS CAPTURED FOR DISPOSAL.

Malcolm Pirnie Inc Oversight Staff's Name (printed):

Douglas Auld

Oversight Staff's Signature

Date: 8/6/2008

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 1 of 1

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

Daily Oversight Summary Form

Form Designation: LPRRP-01-Summary Form			Date: 8/14/2008
Weather Conditions:	Affect Sample Quality:	Air Temp (F):	24-Hour precipitation:
AM: CLEAR & WARM, SLIGHT BREEZE NW	Yes ☑ No (if yes, describe in problems section.)	Min: ~ 75°F Max: ~ 83°F	Start: N/A End:
PM: WARM & SLIGHTLY OVERCAST	☐ Yes ☐ No (if yes, describe in problems section.)	Water Temp (F): ~ 75°F	Amount (in):

Oversight Staff Assignments: Name:	Team/Activity Observed:	Other personnel conducting oversight/official visitors:
DWAYNE ALLD (MALCOLM PIRNIE) CORE / GRAB SAMPLING OVERSIGHT	DAVE KOWALSKI - OSI STEVE GADOMSKI - OSI JEFF HOLZER - EMSE MIKE HAUSER - EMSE	JOHN BOFF (COE-NAN/NYD) RICARDO - EMSE ASSISTING W/ CORE TRANSPORT

Deviations from USEPA-approved work plans: CORE CATCHER UTILIZED ON ALL CORE ATTEMPTS.

Core collection activities: Total # Observed/Reported: _____/_____
Reported: Cores:_____Blanks_____Abandoned_____Other_____

TSI Core ID #	Tube Material Type/Length	Recovery Description (%) and Disposition
2008-CLRC-071 C1	4.1	100% + SAVED FOR PROCESSING
C2	5.0	TOP LOST - CORE ABANDONED
C3	2.0	87% SAVED FOR PROCESSING
2008-CLRC-073 C1	NO RECOVERY	
C2	PENETRATED 5.3'	0% RECOVERED TBD IN PC FACILITY
C3	NO RECOVERY	
C4	4.3	95.5% SAVED FOR PROCESSING

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 2 of 11

Split sample collection activities: Total # Observed/Reported: _____/_____
Reported: Cores:_____Blanks_____Abandoned_____Other_____

Split sampling activities: NO SPLIT SAMPLING PERFORMED

TSI Core ID #	TSI Sample ID #	Comments/Analyses

Decontamination activities: Total # observed Lab: _____ Total # observed Boat: 1

Split sample activity comment: DECON OF POWER DREDGE OBSERVED.

Problems encountered/solutions implemented (if necessary):

MULTIPLE CORE AND GRAB SAMPLE ATTEMPTS REQUIRED AT LOCATION 2008-CLBC-073 TO OBTAIN ADEQUATE SAMPLE VOLUME.

Safety concerns/issues (if any):

N/A

Additional observations/comments (if necessary, Include a description of any water column sampling events conducted):

N/A

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 3 of 11

Miscellaneous comments: N/A

Core/grab collection tasks completed by CPG:	Field activities observed by government oversight personnel:	Total number of cores/grabs processed by CPG:	Lab activities observed by government oversight personnel:
Cores: 7	Cores: 6	Cores: 4	Cores: N/A
Van Veens/Grabs: 10	Van Veens/Grabs: 10	Van Veens/Grabs: 4	Van Veens/Grabs:
Abandoned: 3 cores	Abandoned: 3 cores	Blanks: —	Blanks:
Blanks: — 8 grabs	Blanks: 8 grabs	Samples shipped:	Decon Activities:
Decons:	Decons:		Splits Taken:

Malcolm Pirnie Inc Field Representative Signature:

Printed Name:

Douglas Aund

Total # of pages: 4 of 4

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008-CLRC-071	Northing: 726085.00 Easting: 596759.00	8/14/2008 Time: 0730 - 0840

Name(s) of Contractor Samplers (Include Boat Captain Name):
OCEAN SURVEY, INC. DAVE KOWALSKI - CAPTAIN
STEVE SPOONHOUR - MATE
JEFF HOOVER - ENGR
MIKE HANSEN - ENGR
JOHN WALKER - ENGR

Necessary information (specified in core collection SOP) recorded into the field notebook: ☑ Yes ☐ No (comment:)	Sampling locations agree with those specified in the QAPP/FSP: ☑ Yes ☐ No
Core advanced via: ☐ Pushing (piston/hand) ☑ Vibracore ☐ Other (comment):	Was the core tubing rinsed thoroughly between attempts? ☐ Yes ☐ No ☑ n/a EXTRA LINER TUBES UTILIZED FOR EACH CORE
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ☑ Yes ☐ No	Was a core catcher used? If so, why? ☑ Yes ☐ No SEE COMMENT ON PAGE #2 OF THIS FORM. CATCHER USED ON ALL CORES.
Were multiple attempts made to advance the core? ☐ Yes ☑ No Comment:	Was a short core collected? ☑ Yes ☐ No
	Short Core Designation: C3 Northing: 726082.13 Easting: 596753.14 Offset from Target: 6.53'

Total # of pages: 5 of 11

Core Attempt Chart

TSI Core ID #: 2008-CORE-071

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (ft) FT.	Recovery Depth (ft) FT.	Recovery %	Disposition of attempt*
C1	726084.98	590757.29	1.79	3 5/8"	CORE	LEX	3.8	4.1	100	F
C2	726084.75	590754.50	4.31	3 5/8"	CORE	LEX	3.8	5.0	100	A
C3	726082.13	590753.14	0.53	3 5/8"	CORE	LEX	3.0'	2.6	87	F
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

✓ Core Labeled ✓ Core Sealed ✓ Marked with "Up" ✓ Stored (iced, under tarp)

Deviations:

Correct decontamination procedures performed for field equipment (if applicable):

☐ Proper decontamination solutions used ☐ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

C1: 3.6' BLACK SILT - 0.7' COARSE BROWN SAND. CORE CONNECTED W/ CORE CATCHER. ENSR REPORTS THAT CLARIFICATION REGARDING CORE CATCHER ISSUE HAS NOT BEEN RECEIVED FROM USEPA, SO SOP AS WRITTEN/APPROVED WILL CONTINUE TO BE FOLLOWED.

C2: TOP OF CORE LOST.

C3: 2.0' BLACK SILT TRANSITION TO COARSE BROWN SAND.
0.6' COARSE BROWN SAND.

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS AULD

Oversight Staff's Signature

Date: 8/14/2008

Total # of pages: 6 of 11

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

GRAB SAMPLING

Sediment Grab Designation:	Target Sediment Grab Location:	Date:
2008 - CLRC - 071	Northing: 726685.00 Easting: 590759.00	8/14/2008 Time: 0840 –

Name(s) of Contractor Samplers (Include Boat Captain Name): OCEAN SURVEY, INC. – DAVE KOWALSKI - CAPTN; STEVE GARDOTSKI - MATE; JEFF HOLZOR - ENGR; MIKE HAWORTH - ENGR; JOHN WALKER - ENGR

Necessary information (specified in grab collection SOP) recorded into the field notebooks: ☑ Yes ☐ No (comment:)

Sampling locations agree with those specified in the QAPP/FSP? ☑ Yes ☐ No

Identify the type of grab sampler used (*e.g.*, ponar dredge, van veen sampler, or box corer): PONAR DREDGE W/ STABILIZATION FRAME.

Was the sampler rinsed properly between multiple grab attempts at the same location? ☐ Yes ☑ No ☐ n/a Comment: WATER DEPTH APPROX. 10.5'

Grab Attempt Chart

TSI Grab ID #:

Grab Attempts	Northing	Easting	Offset (ft)	Sample Type (grab/field blank)	Disposition of attempt*	Other Observations
G1	726677.13	590757.58	8.17	GRAB	A	DEBRIS
G2	726680.43	590750.81	9.35	GRAB	A	DEBRIS
G3	726684.07	590750.00	9.05	GRAB	R	NO RECOVERY
Final G4	726684.07	590755.00	9.05	GRAB	F	RETAINED FOR PROCESSING

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

G5 726686.01 590752.74 6.46 GRAB

Total # of pages: 7 of 11

Confirm grab sample labeling and handling by checking appropriate boxes below:

✓ Top 1-inch layer removed for Be-7 analysis ✓ Remaining sample homogenized

✓ VOC collected * ✓ Sample jars stored on ice

Deviations/Comments:

Correct decontamination procedures performed for field equipment (if applicable):

Proper decontamination solutions used ✓ Decontamination waste collected for proper disposal

DECON OF PONAR DREDGE PREVIOUSLY PERFORMED.

Additional comments on sampling operations (if necessary):

GRAB SAMPLE G4 APPEARS TO BE PREDOMINANTLY F-M BROWN SAND.

* G5; VOC's COLLECTED, Be-7 AND COMPOSITE

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS ARMO

Oversight Staff's Signature	Date:
	8/14/2008

Total # of pages: 8 of 11

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008-CLEC-073	Northing: 728360.00 Easting: 596913.00	8/14/2008 Time: 0940 – 1320

Name(s) of Contractor Samplers (Include Boat Captain Name):
OCEAN SURVEY, INC. DAVE KOWALSKI - CAPTN. MIKE HAUSER - ENSR
STEVE GADOMSKI - MATE JEFF HOLZER - ENSR
JOHN WALKER - ENSR

Necessary information (specified in core collection SOP) recorded into the field notebook:
✓ Yes ☐ No (comment:)

Sampling locations agree with those specified in the QAPP/FSP:
✓ Yes ☐ No

Core advanced via:
☐ Pushing (piston/hand) ✓ Vibracore
☐ Other (comment):

Was the core tubing rinsed thoroughly between attempts?
✓ Yes ☐ No ☐ n/a

Was the vibracore motor turned on immediately after the core tube penetrated the sediment?
✓ Yes ☐ No

Was a core catcher used? If so, why?
✓ Yes ☐ No
PURSUANT TO ENSR INTERPRETATION OF SOP.

Were multiple attempts made to advance the core?
✓ Yes ☐ No Comment:

C1 - FIRST ATTEMPT WAS LOST UPON RETRIEVAL. CORE TUBE AND CORE CATCHER RINSED W/ RIVER WATER BETWEEN ATTEMPTS.

C2 - RETAINED, HOWEVER RECOVERY UNCERTAIN

C3 - ABANDONED

C4 - RETAINED FOR PROCESSING

C5 - RETAINED FOR PROCESSING

Was a short core collected?
☐ Yes ☐ No

Short Core Designation: C5

Northing: 728358.85

Easting: 596915.98

Offset from Target: 3.57

Total # of pages: 9 of 11

Core Attempt Chart

TSI Core ID #: 2008-CLEL-073

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (ft) FT.	Recovery Depth (ft) FT.	Recovery %	Disposition of attempt*
C1	728360.01	596911.73	1.68	3 5/8"	CORE	LEX	3.3'	—	—	A
C2	728360.22	596908.33	4.73	3 5/8	CORE	LEX	3.3'	*	*	F
C3	728356.39	596908.54	6.27	3 5/8	CORE	LEX	4.7'	—	—	A
Final C4	728357.31	596911.10	4.15	3 5/8	CORE	LEX	4.5	4.3		F

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

✓ Core Labeled ✓ Core Sealed ✓ Marked with "Up" ✓ Stored (iced, under tarp)

Deviations:

Correct decontamination procedures performed for field equipment (if applicable):

Proper decontamination solutions used Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

C1: REFUSAL ENCOUNTERED AT 3.3'. CORE LOST UPON RETRIEVAL. ABANDONED

C2: RECOVERY UNKNOWN DUE TO MUCKY WATER IN CORE TUBE. APPEARS TO BE GREATER THAN 3'. CORE RETAINED FOR PROCESSING.

C3: CORE ABANDONED DUE TO INADEQUATE RECOVERY.

C4: CORE RETAINED FOR PROCESSING

C5: CORE RETAINED FOR PROCESSING

Malcolm Pirnie Inc Oversight Staff's Name (printed):

Douglas Auld

Oversight Staff's Signature

Date: 8/14/2008

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

GRAB SAMPLING

Sediment Grab Designation:	Target Sediment Grab Location:	Date:
2008-CURC-073	Northing: 728361.00 Easting: 596913.00	8/12 Time: 1320

Name(s) of Contractor Samplers (Include Boat Captain Name):
OCEAN SURVEY, INC. DANE KOWALSKI - CAPTN, STEVE GANDOMSKI - MATE, MIKE HANSER - ENGR, JEFF HOLZER - ENGR, JOHN WALKER - ENGR

Necessary information (specified in grab collection SOP) recorded into the field notebooks:
☑ Yes ☐ No (comment:)

Sampling locations agree with those specified in the QAPP/FSP?
☑ Yes ☐ No

Identify the type of grab sampler used (*e.g.*, ponar dredge, van veen sampler, or box corer):
PONAR DREDGE W/ STABILIZATION FRAME

Was the sampler rinsed properly between multiple grab attempts at the same location?
☑ Yes ☐ No ☐ n/a Comment:

Grab Attempt Chart

TSI Grab ID #:

Grab Attempts	Northing	Easting	Offset (ft)	Sample Type (grab/field blank)	Disposition of attempt*	Other Observations
G1	728354.17	596915.20	7.18	GRAB	A	DEBRIS
G2	728354.26	596910.52	7.18	GRAB	A	BURIED PONAR
G3	728363.73	596911.69	3.05	GRAB	A	BURIED PONAR
Final G10	728355.60	596919.67	8.26	GRAB		

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

G4 728363.07 596915.70 3.80' GRAB F SAMPLE COLLECTED FOR PROCESSING

G5 728360.37 596920.67 7.70' GRAB F SAMPLE COLLECTED FOR PROCESSING

Total # of pages: 11 of 11

Confirm grab sample labeling and handling by checking appropriate boxes below:

☑ Top 1-inch layer removed for Be-7 analysis ☑ Remaining sample homogenized

☑ VOC collected ☑ Sample jars stored on ice

Deviations/Comments:

VOCs COLLECTED FROM GS

Correct decontamination procedures performed for field equipment (if applicable):

☑ Proper decontamination solutions used ☑ Decontamination waste collected for proper disposal

DECONTAMINATION OF PONAR DREDGE PERFORMED BETWEEN LOCATION 071 AND 073

Additional comments on sampling operations (if necessary):

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS AUD

Oversight Staff's Signature

Date: 8/14/2008

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted _____

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

Daily Oversight Summary Form

Form Designation: LPRRP-01-Summary Form			Date: 9/2/2008
Weather Conditions:	Affect Sample Quality:	Air Temp (F):	24-Hour precipitation:
AM: CLEAR	Yes ✓ No (if yes, describe in problems section.)	Min: ~ 70° °F Max: ~ 80° °F	Start: ✓ N/A ? End:
PM: CLEAR	Yes No (if yes, describe in problems section.)	Water Temp (F): ~ 75 °F	Amount (in):

Oversight Staff Assignments:

Name:	Team/Activity Observed:	Other personnel conducting oversight/official visitors:
DOUGLAS AMO	DAVE KOWALSKI - OSI	JOHN ROLFF -
	STEVE GADOMSKI - OSI	DEMAXIMUS
	MIKE HANSEN - ENSR	
	JEFF HOLZER - ENSR	
	JON IMMERMAN - ENSR	

Deviations from USEPA-approved work plans: _____

Core collection activities: Total # Observed/Reported: _____/_____
Reported: Cores:_____Blanks_____Abandoned_____Other_____

TSI Core ID #	Tube Material Type/Length	Recovery Description (%) and Disposition
2008-CURE-070 C1	LEXAN - 10'	0% RECOVERED, ABANDONED
C2	LEXAN - 10'	5.1' RECOVERED, CORE RETAINED FOR PROCESSING
C3	LEXAN - 10'	8.2' RECOVERED, CORE RETAINED FOR PROCESSING
2008-CURE-078 C1	LEXAN - 10'	8.0' RECOVERED, CORE RETAINED FOR PROCESSING.

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted _____

Split sample collection activities: Total # Observed/Reported: _____/_____
Reported: Cores: _____ Blanks _____ Abandoned _____ Other _____

Split sampling activities: NO SPLIT SAMPLING ACTIVITIES PERFORMED.

TSI Core ID #	TSI Sample ID #	Comments/Analyses

Decontamination activities: Total # observed Lab: _____ Total # observed Boat: _____

Split sample activity comment: _____

Problems encountered/solutions implemented (if necessary):
NONE NOTED

Safety concerns/issues (if any):
NONE NOTED

Additional observations/comments (if necessary. Include a description of any water column sampling events conducted):

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted

Miscellaneous comments:

Core/grab collection tasks completed by CPG:	Field activities observed by government oversight personnel:	Total number of cores/grabs processed by CPG:	Lab activities observed by government oversight personnel:
Cores: 4 Van Veens/Grabs: 12 Abandoned: 12 Blanks: — Decons: —	Cores: 4 Van Veens/Grabs: 6 Abandoned: 6 Blanks: — Decons: —	Cores: 4 Van Veens/Grabs: — Blanks: — Samples shipped: —	Cores: Van Veens/Grabs: Blanks: Decon Activities: Splits Taken:

Malcolm Pirnie Inc Field Representative Signature:

Printed Name: Douglas Auld

Total # of pages: _____

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008-CLRC-070	Northing: 724352.00 Easting: 595944.00	9/2/2008 Time: 0815

Name(s) of Contractor Samplers (Include Boat Captain Name): DAVE KOWALSKI (CAPT) STEVE GRADOMSKI (MATE) } OSI
MIKE HANSEN, JEFF HOLZBERG, JOHN WALKER } ENSR

Necessary information (specified in core collection SOP) recorded into the field notebook: ☑ Yes ☐ No (comment:)	Sampling locations agree with those specified in the QAPP/FSP: ☑ Yes ☐ No
Core advanced via: ☐ Pushing (piston/hand) ☑ Vibracore ☐ Other (comment):	Was the core tubing rinsed thoroughly between attempts? ☑ Yes ☐ No ☐ n/a
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ☑ Yes ☐ No	Was a core catcher used? If so, why? ☑ Yes ☐ No NO REASON PROVIDED BY CPG.
Were multiple attempts made to advance the core? ☑ Yes ☐ No Comment:	Was a short core collected? ☐ Yes ☐ No
	Short Core Designation: C3 Northing: 724351.80 Easting: 595937.79 Offset from Target: 6.32

LPRRP-03a-Core Sampling

Total # of pages: _____

Core Attempt Chart

TSI Core ID #: 2008 CLEL-070

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (ft) FT.	Recovery Depth (ft) FT.	Recovery %	Disposition of attempt*
C1	724353.01	595935.45	8.94	3 5/8	CORE	LEX.	0.1'	0.2'	0	A
C2	724350.71	595932.39	11.83	3 5/8	CORE	LEX.	4.5'	5.1'	113	F
C3	724351.80	595937.79	6.32	3 5/8	CORE	LEX.	8.0	8.2	102	F
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

✓ Core Labeled ✓ Core Sealed ✓ Marked with "Up" ✓ Stored (iced, under tarp)

Deviations:

Correct decontamination procedures performed for field equipment (if applicable):

☐ Proper decontamination solutions used ☐ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

C3 - CORE LINER STUCK IN CORE BARREL UPON RETRIEVAL. APPROX. 6" OF MATERIAL LOST FROM BOTTOM OF CORE DURING EXTRACTION.

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS AULD

Oversight Staff's Signature

Date: 9/2/2008

Total # of pages: _____

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

GRAB SAMPLING

Sediment Grab Designation:	Target Sediment Grab Location:	Date:
2008-CREC-070	Northing: 724353.10 Easting: 595949.00	9/2/2008 Time: 1030

Name(s) of Contractor Samplers (Include Boat Captain Name): DAVE KONARSKI, STEVE GADOMSKI 3031; MIKE HANCOCK, JEFF HOMZER, JON WALKER } EHSR

Necessary information (specified in grab collection SOP) recorded into the field notebooks:
✓ Yes No (comment:)

Sampling locations agree with those specified in the QAPP/FSP?
✓ Yes No

Identify the type of grab sampler used (*e.g.*, ponar dredge, van veen sampler, or box corer):
PONAR DREDGE W/ STABILIZATION FRAME & WEIGHTS

Was the sampler rinsed properly between multiple grab attempts at the same location?
✓ Yes No n/a Comment:

Grab Attempt Chart

TSI Grab ID #:

Grab Attempts	Northing	Easting	Offset (ft)	Sample Type (grab/field blank)	Disposition of attempt*	Other Observations
G1	724347.81	595932.55	2.90	GRAB	A	DEBRIS
G2	724352.10	595932.42	0.3	GRAB	A	DEBRIS
G3	—	—	—	—	A	DEBRIS
Final						

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

LPRRP-03b-Grab Sampling

Total # of pages: _____

Confirm grab sample labeling and handling by checking appropriate boxes below:

Top 1-inch layer removed for Be-7 analysis Remaining sample homogenized

VOC collected Sample jars stored on ice

Deviations/Comments: A TOTAL OF 6 ATTEMPTS WERE MADE BY CPG TO OBTAIN GRAB SAMPLES. ALL GRABS CONTAINED LARGE AMOUNTS OF DEBRIS.

Correct decontamination procedures performed for field equipment (if applicable):

Proper decontamination solutions used Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

Malcolm Pirnie Inc Oversight Staff's Name (printed): Douglas Hunt

Oversight Staff's Signature

Date: 9/2/2008

Total # of pages: _____

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008-CORE-078	Northing: 732903.00 Easting: 590800.00	9/2/2008 Time:

Name(s) of Contractor Samplers (Include Boat Captain Name): DAVE KONARSKI - CAPTN. } OSI
STEVE GRADOWSKI - MATE } OSI
MIKE HAUSER } ENSR
JEFF HOMZER } ENSR
JOE WARNER } ENSR

Necessary information (specified in core collection SOP) recorded into the field notebook:
✓ Yes No (comment:)

Sampling locations agree with those specified in the QAPP/FSP:
✓ Yes No

Core advanced via:
Pushing (piston/hand) ✓ Vibracore
Other (comment):

Was the core tubing rinsed thoroughly between attempts?
Yes No ✓ n/a

Was the vibracore motor turned on immediately after the core tube penetrated the sediment?
✓ Yes No

Was a core catcher used? If so, why?
✓ Yes No
NO REASON PROVIDED BY CPG.

Were multiple attempts made to advance the core?
Yes ✓ No Comment:
ONLY 1 ATTEMPT WAS NECESSARY.

Was a short core collected?
✓ Yes No NOT OBSERVED.

Short Core Designation:

Northing:

Easting:

Offset from Target:

LPRRP-03a-Core Sampling

Total # of pages: _____

Core Attempt Chart

TSI Core ID #:

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (ft)	Recovery Depth (ft)	Recovery %	Disposition of attempt*
C1	732902.98	5910799.89	0.11	3 5/8	core	LEXAN	8.5	8.0	94	F
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

☑ Core Labeled ☑ Core Sealed ☑ Marked with "Up" ☑ Stored (iced, under tarp)

Deviations:

Correct decontamination procedures performed for field equipment (if applicable):

☐ Proper decontamination solutions used ☐ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

C1 - 4' BLACK SILT & SAND
4' BLACK SILT & SAND W/TR. COARSE SAND

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS ALLEN

Oversight Staff's Signature

Date: 9/2/2008

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 1 of 11

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

Daily Oversight Summary Form

Form Designation: LPRRP-01-Summary Form			Date: 9/3/2008
Weather Conditions:	Affect Sample Quality:	Air Temp (F):	24-Hour precipitation:
AM: CLEAR & COOL	☐ Yes ☑ No (if yes, describe in problems section.)	Min: ~75°F Max: ~84°F	Start: N/A End:
PM: CLEAR & WARM	☐ Yes ☑ No (if yes, describe in problems section.)	Water Temp (F): ~75°F	Amount (in):

Oversight Staff Assignments: Name:	Team/Activity Observed:	Other personnel conducting oversight/official visitors:
DOUGLAS ARMO	MIKE HAUSER - ENSR	JOHN DALEY (QEA/TAMS)
	JEFF HAUSER - ENSR	
	JON WALKER - ENSR	
	STEVEN GRODZINSKI - OSI	
	DAVE GRODZINSKI - OSI	

Deviations from USEPA-approved work plans: GRAB SAMPLES UNABLE TO BE COLLECTED AT LOCATION 2008-CURC-050 AND 2008-CURC-061 DUE TO DEBRIS & TRASH.

Core collection activities: Total # Observed/Reported: 5 / 5
Reported: Cores: 5 Blanks 0 Abandoned 0 Other 0

TSI Core ID #	Tube Material Type/Length	Recovery Description (%) and Disposition
2008-CURC-050 (C1)	3.0' LEXAN	3.0' (100%) CORE RETAINED FOR PROCESSING
" " (C2)	2.8' LEXAN	2.8' (80%) CORE RETAINED FOR PROCESSING
" " (C3)	3.2' LEXAN	2.8' (87.5%) CORE RETAINED FOR PROCESSING
2008-CURC-061 (C1)	6' LEXAN	6.4 (106%) CORE RETAINED FOR PROCESSING
" " (C2)	6.5' LEXAN	6.0 (92%) CORE RETAINED FOR PROCESSING

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 2 of 11

Split sample collection activities: Total # Observed/Reported: _____/_____
Reported: Cores:_____ Blanks_____ Abandoned_____ Other_____

Split sampling activities: NO SPLIT SAMPLING PERFORMED ON VESSEL.

TSI Core ID #	TSI Sample ID #	Comments/Analyses

Decontamination activities: Total # observed Lab: _____ Total # observed Boat: _____

Split sample activity comment: _____

Problems encountered/solutions implemented (if necessary):

UNABLE TO OBTAIN A SPLIT SAMPLE FROM ONE OF THE GRAB SAMPLES BECAUSE ONE GRAB SAMPLE ATTEMPT FAILED TO OBTAIN AN ACCEPTABLE VOLUME OF FINE GRAINED SEDIMENTS.

Safety concerns/issues (if any):

NONE NOTED

Additional observations/comments (if necessary. Include a description of any water column sampling events conducted):

Miscellaneous comments:

Core/grab collection tasks completed by CPG:	Field activities observed by government oversight personnel:	Total number of cores/grabs processed by CPG:	Lab activities observed by government oversight personnel:
Cores: 5 Van Veens/Grabs: 12 Abandoned: 12 GRABS Blanks: N/A Decons: 1	Cores: 5 Van Veens/Grabs: 12 Abandoned: 12 GRABS Blanks: N/A Decons: 1	Cores: 5 Van Veens/Grabs: Blanks: Samples shipped: 5 CORES SENT TO PROCESSING FACILITY	Cores: Van Veens/Grabs: Blanks: Decon Activities: Splits Taken:

Malcolm Pirnie Inc Field Representative Signature:

Printed Name: Douglas Aves

Total # of pages: 4 of 11

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008-CHEC-050	Northing: 708818.00 Easting: 589357.00	9/3/2008 Time: 0750

Name(s) of Contractor Samplers (Include Boat Captain Name): DAVE KOWALSKI (CAPTN) } OSI
STEVE GRADOWSKI (MATE) }
MIKE HANCOCK
JOHN WINKLER } EASR
JEFF HOLZER }

Necessary information (specified in core collection SOP) recorded into the field notebook: ☑ Yes ☐ No (comment:)	Sampling locations agree with those specified in the QAPP/FSP: ☑ Yes ☐ No
Core advanced via: ☐ Pushing (piston/hand) ☑ Vibracore ☐ Other (comment):	Was the core tubing rinsed thoroughly between attempts? ☐ Yes ☐ No ☑ n/a
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ☑ Yes ☐ No	Was a core catcher used? If so, why? ☑ Yes ☐ No ALL CORES AREA CONSIDERED TO BE SIMILAR TO THAT OF PREVIOUSLY FAILED ATTEMPTS
Were multiple attempts made to advance the core? ☐ Yes ☑ No Comment:	Was a short core collected? ☑ Yes ☐ No
	Short Core Designation: C2 Northing: 708818.48 Easting: 589357.88 Offset from Target: 1.0'

LPRRP-03a-Core Sampling

Total # of pages: 5 of 11

Core Attempt Chart

TSI Core ID #: 2008-CORE-050

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (in)	Recovery Depth (in)	Recovery %	Disposition of attempt*
C1	708814.87	589359.0	3.72	3 5/8	CORE	HEX.	3.0	3.0	100	F
C2	708818.48	589357.88	1.00	3 5/8	CORE	HEX.	3.5	2.8	80	F
C3	708822.50	589355.88	4.96	3 5/8	CORE	HEX.	3.2	2.8	87	F
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

✓ Core Labeled ✓ Core Sealed ✓ Marked with "Up" ✓ Stored (iced, under tarp)

Deviations: NONE NOTED.

Correct decontamination procedures performed for field equipment (if applicable):

" Proper decontamination solutions used " Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

C1: 3.5' - BLACK SILT & SAND
0.4' - DISCARD, RED/BRN SAND & GRAVEL.

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS AUNG

Oversight Staff's Signature

Date: 9/3/2008

Total # of pages: 60 of 11

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

GRAB SAMPLING

Sediment Grab Designation:	Target Sediment Grab Location:	Date:
2008-CLRL-050	Northing: 708818.00 Easting: 589357.00	9/3/2008 Time: 0910

Name(s) of Contractor Samplers (Include Boat Captain Name): DAVE KOWALSKI (CAPTAIN), STEVE GRODZICKI (CHIEF) } OSI; MIKE HANSEN, JON WALKER, JEFF HOLZBOG } ENSR

Necessary information (specified in grab collection SOP) recorded into the field notebooks:
☑ Yes ☐ No (comment:)

Sampling locations agree with those specified in the QAPP/FSP?
☑ Yes ☐ No

Identify the type of grab sampler used (*e.g.*, ponar dredge, van veen sampler, or box corer):
PONAR DREDGE W/ STABILIZATION FRAME.

Was the sampler rinsed properly between multiple grab attempts at the same location?
☑ Yes ☐ No ☐ n/a Comment:

Grab Attempt Chart

TSI Grab ID #:

Grab Attempts	Northing	Easting	Offset (ft)	Sample Type (grab/field blank)	Disposition of attempt*	Other Observations
G1	708814.37	589356.32	2.74		A	
G2	708812.06	589357.54	2.17		A	
G3	708811.03	589361.60	4.63		A	
Final G4	708813.52	589365.41	7.03		A	

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

G5 708820.74 589366.12 9.22 A

G6 708817.05 589369.39 10.61 A

Total # of pages: 2 of 11

Confirm grab sample labeling and handling by checking appropriate boxes below:

Top 1-inch layer removed for Be-7 analysis ☐ Remaining sample homogenized

VOC collected ☐ Sample jars stored on ice

Deviations/Comments:

LO FAILED ATTEMPTS TO COLLECT A GRAB SAMPLE AT 2008-LWBL-0550. LOCATION ABANDONED.

Correct decontamination procedures performed for field equipment (if applicable):

Proper decontamination solutions used ☐ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

Malcolm Pirnie Inc Oversight Staff's Name (printed):

Douglas Auld

Oversight Staff's Signature	Date:
	9/3/2008

Total # of pages: 8 of 11

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008-CREC-0601	Northing: 718819.00 Easting: 591892.00	9/3/2008 Time: 1020

Name(s) of Contractor Samplers (Include Boat Captain Name): DAVE KOMINSKI (CAPT.) STEVEN GADOMSKI (CREW) } OSI
MIKE HANSEN, JEFF HOLZER, JON WALKER } ENSR

Necessary information (specified in core collection SOP) recorded into the field notebook:	Sampling locations agree with those specified in the QAPP/FSP:
☑ Yes ☐ No (comment:)	☑ Yes ☐ No
Core advanced via: ☐ Pushing (piston/hand) ☑ Vibracore ☐ Other (comment):	Was the core tubing rinsed thoroughly between attempts? ☐ Yes ☐ No ☑ n/a
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ☑ Yes ☐ No	Was a core catcher used? If so, why? ☑ Yes ☐ No LOCATION REPORTED TO HAVE SEDIMENTS SIMILAR IN COMPOSITION TO PREVIOUSLY FAILED ATTEMPTS.
Were multiple attempts made to advance the core? ☐ Yes ☑ No Comment: ONLY ONE ATTEMPT WAS NECESSARY FOR EACH CORE ATTEMPT.	Was a short core collected? ☑ Yes ☐ No DUPLICATE CORE Short Core Designation: C2 Northing: 718821.78 Easting: 591892.20 Offset from Target: 2.791

LPRRP-03a-Core Sampling

Total # of pages: 9 OF 11

Core Attempt Chart

TSI Core ID #: 2008-CORE-001

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (in)	Recovery Depth (in)	Recovery %	Disposition of attempt*
C1	718818.14	591890.96	NS	3 5/8	CORE	HEX.	60"	60.4"	100	L
C2	718821.78	591892.20	2.19	3 5/8	CORE	HEX.	60.5"	60.0	92	F
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

✓ Core Labeled ✓ Core Sealed ✓ Marked with "Up" ✓ Stored (iced, under tarp)

Deviations: NONE NOTED

Correct decontamination procedures performed for field equipment (if applicable):

☐ Proper decontamination solutions used ☐ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

C1 - CORE CATCHER UTILIZED.
4' - BLACK SILT & SAND
2.7' - RED/BROWN SAND
0.3' - DISCARD SAND & GRAVEL

C2 - CORE CATCHER UTILIZED
4' - BLACK SILT & SAND
1.6' - RED/BROWN SAND
0.4' DISCARD, RED/BRN SAND

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS AULD

Oversight Staff's Signature: [signature]

Date: 9/3/2008

Total # of pages: 10 of 11

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

GRAB SAMPLING

Sediment Grab Designation:	Target Sediment Grab Location:	Date:
2008 - CLRC - 001	Northing: 718819.00 Easting: 591892.00	9/3/2008 Time: 11:10

Name(s) of Contractor Samplers (Include Boat Captain Name): DAVE KOWALSKI - OSI, STEVE GARDOMSKI - OSI, MIKE HANOSZ - ENSR, JEFF HANOSZ - ENSR, JOHN WALKER - ENSR

Necessary information (specified in grab collection SOP) recorded into the field notebooks: ☑ Yes ☐ No (comment:)

Sampling locations agree with those specified in the QAPP/FSP? ☑ Yes ☐ No

Identify the type of grab sampler used (*e.g.*, ponar dredge, van veen sampler, or box corer): PONAR DREDGE W/ STABILIZATION FRAME & WEIGHTS

Was the sampler rinsed properly between multiple grab attempts at the same location? ☑ Yes ☐ No ☐ n/a Comment:

Grab Attempt Chart

TSI Grab ID #:

Grab Attempts	Northing	Easting	Offset (ft)	Sample Type (grab/field blank)	Disposition of attempt*	Other Observations
G1	—	—	—	GRAB	A	
G2	—	—	—	GRAB	A	
G3	—	—	—	GRAB	A	
Final G4	—	—	—	GRAB	A	
G5	—	—	—	GRAB	A	
G6	—	—	—	GRAB	A	

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

LPRRP-03b-Grab Sampling

Total # of pages: 11 of 11

Confirm grab sample labeling and handling by checking appropriate boxes below:

Top 1-inch layer removed for Be-7 analysis Remaining sample homogenized

VOC collected Sample jars stored on ice

Deviations/Comments: NO SAMPLE COLLECTED AFTER (2) FAILED ATTEMPTS. SEDIMENTS WITHIN MOSTLY LEAF DEBRIS, STICKS & TRASH.

Correct decontamination procedures performed for field equipment (if applicable):

✓ Proper decontamination solutions used ✓ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

Malcolm Pirnie Inc Oversight Staff's Name (printed):

Douglas Aucoin

Oversight Staff's Signature	Date:
	9/3/2008

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 1 of 9

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

Daily Oversight Summary Form

Form Designation: LPRRP-01-Summary Form			Date: 9/9/2008
Weather Conditions:	Affect Sample Quality:	Air Temp (F):	24-Hour precipitation:
AM: CLEAR & WARM	Yes ✓No (if yes, describe in problems section.)	Min: ~73°F Max: 86°F	Start: End:
PM: CLEAR & WARM	Yes No (if yes, describe in problems section.)	Water Temp (F): ~75°F	Amount (in):

Oversight Staff Assignments: Name:	Team/Activity Observed:	Other personnel conducting oversight/official visitors:
DOUGLAS AUBO	DAVE KONASEK - OSI	JOHN DOLFF
	JAY DEGREENDO - OSI	DETROIT 913
	MIKE HAUSER - ENSR	
	JEFF HAUSER - ENSR	

Deviations from USEPA-approved work plans: NONE NOTED

Core collection activities: Total # Observed/Reported: _____/_____
Reported: Cores:_____Blanks_____Abandoned_____Other_____

TSI Core ID #	Tube Material Type/Length	Recovery Description (%) and Disposition
2008-CRR-068-C1	LEXAN - 10'	9.6' RECOVERED - CORE RETAINED FOR PROCESSING
" " - C2	LEXAN - 10'	8.7' RECOVERED - CORE RETAINED FOR PROCESSING
2008-CRR-069-C1	LEXAN - 10'	7.6' RECOVERED - CORE RETAINED FOR PROCESSING
" " - C2	LEXAN - 10'	7.3' RECOVERED - CORE RETAINED FOR PROCESSING

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 2 of 9

Split sample collection activities: Total # Observed/Reported: _____/_____
Reported: Cores: _____ Blanks _____ Abandoned _____ Other _____

Split sampling activities: NO SPLIT SAMPLING PERFORMED

TSI Core ID #	TSI Sample ID #	Comments/Analyses

Decontamination activities: Total # observed Lab: _____ Total # observed Boat: _____

Split sample activity comment: _____

Problems encountered/solutions implemented (if necessary):
START WAS TO COLLECT SPLIT SAMPLE OF A GRAB/POINT SAMPLE FOR VOC ANALYSIS. SAMPLE WAS NOT ABLE TO BE COLLECTED BECAUSE CREW WAS UNABLE TO GET A USABLE GRAB SAMPLE AT ENTIRE LOCATION 068 OR 069.

Safety concerns/issues (if any):
NONE NOTED

Additional observations/comments (if necessary. Include a description of any water column sampling events conducted):

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 3 of 9

Miscellaneous comments:

Core/grab collection tasks completed by CPG: Cores: 4 Van Veens/Grabs: 12 Abandoned: 12 grabs Blanks: Decons:	Field activities observed by government oversight personnel: Cores: 4 Van Veens/Grabs: 12 Abandoned: 12 grabs Blanks: Decons:	Total number of cores/grabs processed by CPG: Cores: Van Veens/Grabs: Blanks: Samples shipped:	Lab activities observed by government oversight personnel: Cores: Van Veens/Grabs: Blanks: Decon Activities: Splits Taken:

Malcolm Pirnie Inc Field Representative Signature:

Printed Name: Douglas Aumo

Total # of pages: 4 of 9

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008 - CORE - 068	Northing: 724016.00 Easting: 595000.00	9/4/2008 Time: 0820

Name(s) of Contractor Samplers (Include Boat Captain Name): DAVE KOWALSKI (CAPTN) } OSI
JAY DELORENZO (CMTE) }
MIKE HAUSER } EOSR
JEFF HOLZER }

Necessary information (specified in core collection SOP) recorded into the field notebook: ✓ Yes No (comment:)	Sampling locations agree with those specified in the QAPP/FSP: ✓ Yes No
Core advanced via: Pushing (piston/hand) ✓ Vibracore Other (comment):	Was the core tubing rinsed thoroughly between attempts? Yes No ✓ n/a ONLY 1 ATTEMPT PER CORE NECESSARY.
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ✓ Yes No	Was a core catcher used? If so, why? ✓ Yes No NO REASON PROVIDED BY CPG.
Were multiple attempts made to advance the core? Yes ✓ No Comment:	Was a short core collected? ✓ Yes No DUPLICATE CORE
	Short Core Designation: C2 Northing: 724014.71 Easting: 594998.34 Offset from Target:

LPRRP-03a-Core Sampling

Total # of pages: 5 of 9

Core Attempt Chart

TSI Core ID #: 2008-CLBL-0608

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (in)	Recovery Depth (in)	Recovery %	Disposition of attempt*
C1	724014.70	595080.34	1.34	3 5/8	CORE	LEX.	9.5	9.6	101	F
C2	724019.71	594998.34	2.10	3 5/8	CORE	LEX.	9.5	8.7	91	F
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

✓ Core Labeled ✓ Core Sealed ✓ Marked with "Up" ✓ Stored (iced, under tarp)

Deviations: NONE NOTED.

Correct decontamination procedures performed for field equipment (if applicable):

Proper decontamination solutions used Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

Malcolm Pirnie Inc Oversight Staff's Name (printed):

Douglas Auld

Oversight Staff's Signature

Date: 9/4/2008

Total # of pages: 6 of 9

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

GRAB SAMPLING

Sediment Grab Designation:	Target Sediment Grab Location:	Date:
2008-CRRL-068	Northing: 724016.00 Easting: 595000.00	9/4/2008
		Time: 0940

Name(s) of Contractor Samplers (Include Boat Captain Name):
DAVE KOWALSKI, JAY DELORENZO } OSI
MIKE HANSEN, JEFF HANSEN } ENSR

Necessary information (specified in grab collection SOP) recorded into the field notebooks:
✓ Yes No (comment:)

Sampling locations agree with those specified in the QAPP/FSP?
✓ Yes No

Identify the type of grab sampler used (*e.g.*, ponar dredge, van veen sampler, or box corer):
PONAR DREDGE W/ STABILIZATION FRAME

Was the sampler rinsed properly between multiple grab attempts at the same location?
✓ Yes No n/a Comment:

Grab Attempt Chart

TSI Grab ID #:

Grab Attempts	Northing	Easting	Offset (ft)	Sample Type (grab/field blank)	Disposition of attempt*	Other Observations
G1	724016.04	595000.58	1.36	GRAB	A	
G2	724018.85	595006.57	7.49	GRAB	A	
G3	724012.56	595005.41	5.5	GRAB	A	
Final G4	724009.18	595003.18	6.21	GRAB	F	SAMPLE COLLECTED FOR BEZ.

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

G5 724008.73 594998.67 6.20 GRAB A
G6 724011.21 594995.83 5.70 GRAB F SAMPLE COLLECTED FOR VOC ANALYSIS

LPRRP-03b-Grab Sampling

Total # of pages: 7 of 9

Confirm grab sample labeling and handling by checking appropriate boxes below:

✓ Top 1-inch layer removed for Be-7 analysis ✓ Remaining sample homogenized

✓ VOC collected Sample jars stored on ice

Deviations/Comments: 60 GRAB ATTEMPTS NECESSARY TO OBTAIN ADEQUATE SAMPLE.

Correct decontamination procedures performed for field equipment (if applicable):

✓ Proper decontamination solutions used ✓ Decontamination waste collected for proper disposal

DECON OF DRILLING PERFORMED BETWEEN CORING LOCATIONS.

Additional comments on sampling operations (if necessary):

Malcolm Pirnie Inc Oversight Staff's Name (printed):

Douglas Aug

Oversight Staff's Signature	Date:
	9/4/2008

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008 - CORE - 069	Northing: 595824.83 Easting: 724486.42	9/4/2008 Time: 1310

Name(s) of Contractor Samplers (Include Boat Captain Name): DAVE KOWALSKI - CAPTN, JAY DELORENZO - MATE } OSI; MIKE HAUSER, JEFF HOLZER } ENSR

Necessary information (specified in core collection SOP) recorded into the field notebook: ✓ Yes No (comment:)	Sampling locations agree with those specified in the QAPP/FSP: ✓ Yes No
Core advanced via: Pushing (piston/hand) ✓ Vibracore Other (comment):	Was the core tubing rinsed thoroughly between attempts? Yes No ✓ n/a
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ✓ Yes No	Was a core catcher used? If so, why? ✓ Yes No
Were multiple attempts made to advance the core? Yes ✓ No Comment: ONLY ONE ATTEMPT NECESSARY FOR EACH CORE ATTEMPT.	Was a short core collected? ✓ Yes No DUPLICATE Short Core Designation: C2 Northing: 724484.11 Easting: 595819.78 Offset from Target: 0.79'

LPRRP-03a-Core Sampling

Total # of pages: 9 of 9

Core Attempt Chart

TSI Core ID #: 2008-CBC-009

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (~~in~~) FT	Recovery Depth (~~in~~) FT	Recovery %	Disposition of attempt*
C1	724486.42	595824.83	3.72	3 5/8	core	lex.	7.0	7.10	108	F
C2	724484.11	595819.78	0.79	3 5/8	core	lex.	7.0	7.3	104	F
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

✓ Core Labeled ✓ Core Sealed ✓ Marked with "Up" ✓ Stored (iced, under tarp)

Deviations:

Correct decontamination procedures performed for field equipment (if applicable):

Proper decontamination solutions used — Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

Malcolm Pirnie Inc Oversight Staff's Name (printed):

Douglas Arnold

Oversight Staff's Signature

Date: 9/4/2008

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 1 of 7

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

Daily Oversight Summary Form

Form Designation: LPRRP-01-Summary Form			Date: 9/8/2008
Weather Conditions:	Affect Sample Quality:	Air Temp (F):	24-Hour precipitation:
AM: CLEAR W/ SLIGHT BREEZE	Yes ☑ No (if yes, describe in problems section.)	Min: ~ 65°F Max: ~ 80°F	Start: N/A End:
PM: CLEAR & WARM	Yes No (if yes, describe in problems section.)	Water Temp (F): ~ 75°F	Amount (in):

Oversight Staff Assignments: Name:	Team/Activity Observed:	Other personnel conducting oversight/official visitors:
DOUGLAS AUBO	STEVE GRODSKI - COR	JOHN BOFFA - DEMAXIMUS
	JOHN WETMUR - COR	
	MIKE HAUSER - FMSR	
	JEFF HOLZER - FMSR	

Deviations from USEPA-approved work plans: CORING VESSEL RELOCATED ON LOCATION 076 300' S. OF TARGET LOCATION AFTER 3 FAILED ATTEMPTS TO GET AN ACCEPTABLE CORE AT TARGET LOCATION.

Core collection activities: Total # Observed/Reported: 5 / 5
Reported: Cores: 5 Blanks ____ Abandoned ____ Other ____
NO GRAB SAMPLE COLLECTION OBSERVED.

TSI Core ID #	Tube Material Type/Length	Recovery Description (%) and Disposition
2008-CURR-076 C1	LEXAN - 6'	INADEQUATE PEN. / ABANDONED
C2	LEXAN - 6'	" " "
C3	LEXAN - 6'	" " "
VESSEL RELOCATED 300' S. OF TARGET C4	LEXAN - 6'	3.2'; SILT - SAND & GRAVEL
C5	LEXAN - 6'	4.9'; SILT - SAND & GRAVEL

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 2 of 7

Split sample collection activities: Total # Observed/Reported: _____/_____
Reported: Cores: _____ Blanks _____ Abandoned _____ Other _____

Split sampling activities: NO SPLIT SAMPLING ACTIVITIES PERFORMED

TSI Core ID #	TSI Sample ID #	Comments/Analyses

Decontamination activities: Total # observed Lab: _____ Total # observed Boat: _____

Split sample activity comment: _____

Problems encountered/solutions implemented (if necessary):

CORING VESSEL RUNS OUT OF FUEL FOR VIBRACORE GENERATOR AT 0950. TENDER VESSEL SENT TO DOCK TO OBTAIN ADDITIONAL FUEL.
UNABLE TO OBTAIN ANY SEDIMENT CORE FROM ACTIVITIES BECAUSE OF INADEQUATE SPACE ON CORING VESSEL.

Safety concerns/issues (if any):

NONE NOTED.

Additional observations/comments (if necessary. Include a description of any water column sampling events conducted):

CORING ACTIVITIES BEING PERFORMED FROM A SMALLER OSV VESSEL, THAT "WILL DO". DUE TO LACK OF SPACE ON CORING VESSEL, ALL OVERNIGHT ICE REQUIRED FROM DEPARTING TENDER BOAT. TENDER BOAT PERIODICALLY LEAVES CORING SITES TO FERRY CORES BACK TO DOCK FOR TRANSPORT TO PROCESSING BY FRENCH.

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 3 of 7

Miscellaneous comments:

Core/grab collection tasks completed by CPG: Cores: Van Veens/Grabs: Abandoned: Blanks: Decons:	Field activities observed by government oversight personnel: Cores: 5 Van Veens/Grabs: 0 Abandoned: 3 Blanks: N/A Decons: N/A	Total number of cores/grabs processed by CPG: Cores: Van Veens/Grabs: Blanks: Samples shipped:	Lab activities observed by government oversight personnel: Cores: Van Veens/Grabs: Blanks: Decon Activities: Splits Taken:

Malcolm Pirnie Inc Field Representative Signature:

Printed Name: Douglas Auld

Total # of pages: 4 of 7

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008-CORE-07LB	Northing: 731058.00 Easting: 594110.00	9/8/2008 Time: 0908

Name(s) of Contractor Samplers (Include Boat Captain Name): JOHN WESTMEIER - CAPT } MIKE HANSEN } EDISON
STEVE GRODZINSKI - MATE } 031 JEFF HOLZER }

Necessary information (specified in core collection SOP) recorded into the field notebook: ✓ Yes No (comment:)	Sampling locations agree with those specified in the QAPP/FSP: ✓ Yes No
Core advanced via: Pushing (piston/hand) ✓ Vibracore Other (comment):	Was the core tubing rinsed thoroughly between attempts? ✓ Yes No n/a
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ✓ Yes No	Was a core catcher used? If so, why? ✓ Yes No NO REASON PROVIDED BY CPG.
Were multiple attempts made to advance the core? ✓ Yes No Comment:	Was a short core collected? Yes ✓ No
	Short Core Designation: Northing: N/A Easting: Offset from Target:

LPRRP-03a-Core Sampling

Total # of pages: 5 OF 7

Core Attempt Chart

TSI Core ID #:

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (ft) FT.	Recovery Depth (ft) FT.	Recovery %	Disposition of attempt*
C1	731058.39	596108.54	1.51	3 5/8	CORE	LEX.	1.0'	0.6'	60	A
C2	731063.82	596101.41	6.84	3 5/8	CORE	LEX.	0.7'	0.3'	73	A
C3	731070.21	596102.77	14.23	3 5/8	CORE	LEX.	1.2	2.0	100	A
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

Core Labeled Core Sealed Marked with "Up" Stored (iced, under tarp)

Deviations: UNABLE TO COLLECT USABLE CORE.

Correct decontamination procedures performed for field equipment (if applicable):

Proper decontamination solutions used Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

C2, C2 & C3 - MATERIAL IN BOTTOM OF CORE APPEARS TO BE PREDOMINANTLY SAND & GRAVEL.

UNABLE TO OBTAIN A USABLE CORE AT THIS LOCATION, COUNTY VERBALLY TO RELOCATE APPROX. 300' SOUTH.

Malcolm Pirnie Inc Oversight Staff's Name (printed):

Douglas Auld

Oversight Staff's Signature

Date: 9/8/2008

Total # of pages: 6 of 7

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008 - CURC - 076	Northing: 731058.00 Easting: 596110.00	9/8/2008 Time: 0921

Name(s) of Contractor Samplers (Include Boat Captain Name): JOHN WESTMEIR - CAPTN. STEVE GRADOWSKI - MARK } 031 MIKE HANSON JEFF ADLER } ENGR

Necessary information (specified in core collection SOP) recorded into the field notebook: ✓ Yes No (comment:)	Sampling locations agree with those specified in the QAPP/FSP: ✓ Yes No
Core advanced via: Pushing (piston/hand) ✓ Vibracore Other (comment):	Was the core tubing rinsed thoroughly between attempts? ✓ Yes No n/a
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ✓ Yes No	Was a core catcher used? If so, why? ✓ Yes No NO REASON PROVIDED BY CPG
Were multiple attempts made to advance the core? ✓ Yes No Comment: LOCATION MOVED 300' SOUTH AFTER 3 FAILED ATTEMPTS AT TARGET LOCATION.	Was a short core collected? ✓ Yes No Short Core Designation: DUPLICATE CORE 2008 - CURC - 076 - C5 Northing: 730760.85 Easting: 596104.00 Offset from Target: 297.24

LPRRP-03a-Core Sampling

Total # of pages: 7 of 7

Core Attempt Chart

TSI Core ID #:

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (ft) Ft.	Recovery Depth (ft) Ft.	Recovery %	Disposition of attempt*
C4	730757.25	5910108.73	301.08	3 5/8	CORE	LEX.	4.0	3.2	80	F
C5	730760.85	5910104.00	297.23	3 5/8	CORE	LEX.	4.1	4.9	119	F
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

Core Labeled Core Sealed Marked with "Up" Stored (iced, under tarp)

Deviations:

Correct decontamination procedures performed for field equipment (if applicable):

Proper decontamination solutions used Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

C4 - TOP ~ 1' OF CORE APPEARS TO BE BLACK SILTY SAND FOLLOWED BY RED/BROWN SAND & GRAVEL TO BOTTOM OF CORE.

C5 - CORE CATCHER MOMENTARILY BECOMES FREE OF CORE TUBE DURING EXTRACTION ALLOWING FOR SEDIMENT IN TUBE TO SHIFT APPROX. 4-10". SEDIMENT IN CORE APPEARS TO BE APPROX. 1' OF BLACK SILTY SAND FOLLOWED BY RED/BRN SILTY SAND.

Malcolm Pirnie Inc Oversight Staff's Name (printed):

Douglas Auld

Oversight Staff's Signature

Date: 9/8/2008

LPRRP 01-Daily Oversight Summary Form
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Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

Daily Oversight Summary Form

Form Designation: LPRRP-01-Summary Form			Date: 9/11/2008
Weather Conditions:	Affect Sample Quality:	Air Temp (F):	24-Hour precipitation:
AM: CLOUDY & COOL	Yes No (if yes, describe in problems section.)	Min: ~ 60°F Max: ~ 78°F	Start: N/A End:
PM: CLEAR & WARM	☐ Yes ☐ No (if yes, describe in problems section.)	Water Temp (F): ~ 68°F	Amount (in):

Oversight Staff Assignments: Name:	Team/Activity Observed:	Other personnel conducting oversight/official visitors:
DOUGLAS ARNOLD	JOHN WETMORE - OSI	JOHN ZOLFF - DEMYSTIFIS
	STEVE GRZESINSKI - OSI	DON BOYE - ENSR
	MIKE HAUSER - ENSR	CLIFF FIESTENBERG - TIERRA SOLUTIONS
	JEFF HOWARD - ENSR	

Deviations from USEPA-approved work plans: LOCATION 082 ABANDONED PRIOR TO OVERSIGHT ARRIVAL AT 0815 BECAUSE CORE BARREL ON COUNTY VESSEL "WILLOW" IS NOT ADEQUATELY LONG ENOUGH.

Core collection activities: Total # Observed/Reported: _____/_____
Reported: Cores:_____Blanks_____Abandoned_____Other_____

TSI Core ID #	Tube Material Type/Length	Recovery Description (%) and Disposition
2008-CWL-083 C1	9' CORE BARREL	9.9' OF PENETRATION 7.3' RECOVERY - 72%
" " " C2	9' CORE BARREL	6.0' OF PENETRATION 4.8' RECOVERY - 80%
2008-CWL-090 C1	9' CORE BARREL	1.8' OF PENETRATION 1.6' OF RECOVERY RETRIEVED
" " " C2	9' CORE BARREL	RECOVERY LESS THAN 1' CORE ABANDONED
" " " C3	9' CORE BARREL	RECOVERY LESS THAN 1' CORE ABANDONED
" " " C4	9' CORE BARREL	6.0' OF PENETRATION 2.2' OF RECOVERY RETRIEVED
" " " C5	9' CORE BARREL	6.0' OF PENETRATION 2.6' OF RECOVERY

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 2 OF 9

Split sample collection activities: Total # Observed/Reported: _____/_____
Reported: Cores:_____Blanks_____Abandoned_____Other_____

Split sampling activities: NO SPLIT SAMPLING PERFORMED ON VESSEL

TSI Core ID #	TSI Sample ID #	Comments/Analyses

Decontamination activities: Total # observed Lab: _____ Total # observed Boat: _____

Split sample activity comment: _____

Problems encountered/solutions implemented (if necessary):

THE OSV VESSEL THAT IS CURRENTLY BEING USED, THE "WINDY" DOES NOT HAVE ROOM FOR GOVT OVERSIGHT PERSONNEL. AS A RESULT ALL OVERSIGHT IS PERFORMED FROM DEMARCO'S TENDER BOAT. HOWEVER, GRAB SAMPLES CANNOT BE OBSERVED, BECAUSE TENDER BOAT TRANSPORTS CORES TO PROCESSING FACILITY IMMEDIATELY AFTER COLLECTION.

Safety concerns/issues (if any):

NONE NOTED.

Additional observations/comments (if necessary. Include a description of any water column sampling events conducted):

GRAB SAMPLES FROM 2008-CURL-090 NOT OBSERVED DUE TO TENDER BOAT LEAVING SITE FOR THE DAY W/ CORES.

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 3 of 9

Miscellaneous comments:

Core/grab collection tasks completed by CPG:	Field activities observed by government oversight personnel:	Total number of cores/grabs processed by CPG:	Lab activities observed by government oversight personnel:
Cores: 7 Van Veens/Grabs: 5 Abandoned: 3 cores Blanks: 1 grab Decons:	Cores: 7 Van Veens/Grabs: 1 Abandoned: 3 cores Blanks: Decons:	Cores: Van Veens/Grabs: Blanks: Samples shipped:	Cores: Van Veens/Grabs: Blanks: Decon Activities: Splits Taken:

Malcolm Pirnie Inc Field Representative Signature:

Printed Name: Douglas Aus

Total # of pages: 4 of 9

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008-CURC-083	Northing: 737973 Easting: 597459	9/11/2008 Time: 0825

Name(s) of Contractor Samplers (Include Boat Captain Name): JOHN WESTNEAT, STEVE GRADOWSKI } EOL; MIKE HANSEN, JEFF HOLZER } ESE

Necessary information (specified in core collection SOP) recorded into the field notebook: ☑ Yes ☐ No (comment:)	Sampling locations agree with those specified in the QAPP/FSP: ☑ Yes ☐ No
Core advanced via: ☐ Pushing (piston/hand) ☑ Vibracore ☐ Other (comment):	Was the core tubing rinsed thoroughly between attempts? ☑ Yes ☐ No ☑ n/a
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ☑ Yes ☐ No	Was a core catcher used? If so, why? ☑ Yes ☐ No CORE CATCHERS HAVE BEEN USED THROUGHOUT PROGRAM
Were multiple attempts made to advance the core? ☐ Yes ☑ No Comment:	Was a short core collected? ☑ Yes ☐ No DUPLICATE Short Core Designation: 2008-CURC-083-C2 Northing: 737974.22 Easting: 597461.60 Offset from Target: ~~OFF SET~~ NOT RECORDED BY OVERSIGHT

LPRRP-03a-Core Sampling

Total # of pages: 5 of 9

Core Attempt Chart

TSI Core ID #:

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (ft)	Recovery Depth (ft)	Recovery %	Disposition of attempt*
C1	737973.27	597457.71	-	3 1/8	core	Lex.	5.9	4.3	73	S
C2	737974.22	597461.60	-	3 1/8	core	Lex.	6.0	4.8	80	S
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

✓ Core Labeled ✓ Core Sealed ✓ Marked with "Up" ✓ Stored (iced, under tarp)

Deviations:

Correct decontamination procedures performed for field equipment (if applicable):

☐ Proper decontamination solutions used ☐ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

Malcolm Pirnie Inc Oversight Staff's Name (printed):

Douglas Ano

Oversight Staff's Signature

Date: 9/11/2008

Total # of pages: 60 of 9

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

GRAB SAMPLING

Sediment Grab Designation:	Target Sediment Grab Location:	Date:
2008-CURL-083	Northing: 737973 Easting: 597459	9/11/2008 Time: ✓ 0930

Name(s) of Contractor Samplers (Include Boat Captain Name): JOHN WESTMEIER, STEVE GRODSKI } OSI; MIKE HANSEN, JEFF HOUSER } EA&E

Necessary information (specified in grab collection SOP) recorded into the field notebooks:	Sampling locations agree with those specified in the QAPP/FSP?
✓ Yes ☐ No (comment:)	✓ Yes ☐ No

Identify the type of grab sampler used (*e.g.*, ponar dredge, van veen sampler, or box corer):

PONAR DREDGE W/ STABILIZATION FRAME

Was the sampler rinsed properly between multiple grab attempts at the same location?

✓ Yes No n/a Comment:

Grab Attempt Chart

TSI Grab ID #:

Grab Attempts	Northing	Easting	Offset (ft)	Sample Type (grab/field blank)	Disposition of attempt*	Other Observations
G1	737978.72	597463.08	—	GRAB	A	
G2	737979.88	597459.38	—	GRAB	S	BC3 COLLECTED
G3	737984.24	597458.93	—	GRAB	S	VOC COLLECTED
Final						

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Total # of pages: 7 of 9

Confirm grab sample labeling and handling by checking appropriate boxes below:

✓ Top 1-inch layer removed for Be-7 analysis ✓ Remaining sample homogenized

✓ VOC collected ✓ Sample jars stored on ice

Deviations/Comments:

GRAB SAMPLE COLLECTION NOT OBSERVED DUE TO TEMPORARY BOAT TRANSPORTING CORES TO PROCESSING FACILITY.

Correct decontamination procedures performed for field equipment (if applicable):

✓ Proper decontamination solutions used ✓ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS AUD

Oversight Staff's Signature	Date:
	9/11/2008

Total # of pages: 8 of 9

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008-CRC-090	Northing: 739764 Easting: 600361	9/11/2008 Time: ~ 11:00

Name(s) of Contractor Samplers (Include Boat Captain Name): JOHN WETMORE, STEVE CHODOSKI, MIKE HANSEN, JEFF HOLZER, ENSR

Necessary information (specified in core collection SOP) recorded into the field notebook:	Sampling locations agree with those specified in the QAPP/FSP:
✓ Yes No (comment:)	✓ Yes No
Core advanced via: ☐ Pushing (piston/hand) ✓ Vibracore ☐ Other (comment):	Was the core tubing rinsed thoroughly between attempts? ✓ Yes ☐ No ☐ n/a
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ✓ Yes No	Was a core catcher used? If so, why? ✓ Yes ☐ No CORE CATCHER USED THROUGHOUT PROGRAM
Were multiple attempts made to advance the core? ✓ Yes ☐ No Comment:	Was a short core collected? ☐ Yes ☐ No
	Short Core Designation: Northing: Easting: Offset from Target:

LPRRP-03a-Core Sampling

Total # of pages: 9 of 9

Core Attempt Chart

TSI Core ID #:

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (ft)	Recovery Depth (ft)	Recovery %	Disposition of attempt*
C1	739771.43	600371.99	-	3 5/8	CORE	LEX	1.8	1.6	88	S
C2	739772.43	600377.78	18.8	3 5/8	CORE	LEX	1.4	0.8	-	A
C3	739781.43	600374.41	22	3 5/8	CORE	LEX	6	0.8	-	A
Final C4	739777.61	600373.42	18.4	3 5/8	CORE	LEX	6	2.2	36	A

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

☒ Core Labeled ☒ Core Sealed ☐ Marked with "Up" ☐ Stored (iced, under tarp)

Deviations:

Correct decontamination procedures performed for field equipment (if applicable):

☐ Proper decontamination solutions used ☐ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

C5 NO COORDINATES OBTAINED. ACTUAL PENETRATION WAS 6.0' WITH 2.6' OF RECOVERY. CORE RETAINED FOR PROCESSING, APPEARED TO BE F-C RED/BROWN SAND & GRAVEL.

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS AUD

Oversight Staff's Signature

Date: 9/11/2008

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 1 of 9

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

Daily Oversight Summary Form

Form Designation: LPRRP-01-Summary Form			Date: 9/22/2008
Weather Conditions:	Affect Sample Quality:	Air Temp (F):	24-Hour precipitation:
AM: COOL & CLEAR	Yes No (if yes, describe in problems section.)	Min: ~ 50's °F Max:	Start: N/A End:
PM: CLEAR & WARM	Yes No (if yes, describe in problems section.)	Water Temp (F):	Amount (in):

Oversight Staff Assignments: Name:	Team/Activity Observed:	Other personnel conducting oversight/official visitors:
DOUGLAS ARMO	STEVE GADOMSKI - CB1	JOHN BOYLE - DEMAYO/LIS
	JAY DELORENZO - CB1	
	MIKE HAUSER - ENSR	
	JEFF HOLZER - ENSR	

Deviations from USEPA-approved work plans: _____

Core collection activities: Total # Observed/Reported: _____/_____
Reported: Cores:_____Blanks_____Abandoned_____Other_____

TSI Core ID #	Tube Material Type/Length	Recovery Description (%) and Disposition
2008-CORE-041 C1	9' CORE BARREL	5.5' RECOVERY (100%) SAMPLED
" " " C2	9' CORE BARREL	4.5' RECOVERY (73%) SAMPLED
2008-CORE-042 C1	9' CORE BARREL	4.9' RECOVERY (73%) SAMPLED
" " " C2	9' CORE BARREL	6.2' RECOVERY (103%) SAMPLED

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 2 of 9

Split sample collection activities: Total # Observed/Reported: _____/_____
Reported: Cores:_____Blanks_____Abandoned_____Other_____

Split sampling activities: NO SPLIT SAMPLING ACTIVITIES PERFORMED

TSI Core ID #	TSI Sample ID #	Comments/Analyses

Decontamination activities: Total # observed Lab: _____ Total # observed Boat: _____

Split sample activity comment:_____

Problems encountered/solutions implemented (if necessary):

NOT ABLE TO BOARD SAMPLING VESSEL "WILLIDU"
AS A RESULT, CANNOT OBSERVE COLLECTION OF CORE
SAMPLES BECAUSE TENDER BOAT TRANSPORTS
CORES TO PROCESSING FACILITY IMMEDIATELY
UPON COLLECTION.

Safety concerns/issues (if any):

NONE NOTED.

Additional observations/comments (if necessary. Include a description of any water column sampling events conducted):

LPRRP 01-Daily Oversight Summary Form
Total # of pages submitted 3 of 9

Miscellaneous comments:

Core/grab collection tasks completed by CPG: Cores: 4 Van Veens/Grabs: 5 Abandoned: 1 GRAB Blanks: Decons:	Field activities observed by government oversight personnel: Cores: 4 Van Veens/Grabs: Ø Abandoned: Blanks: Decons:	Total number of cores/grabs processed by CPG: Cores: Van Veens/Grabs: Blanks: Samples shipped:	Lab activities observed by government oversight personnel: Cores: Van Veens/Grabs: Blanks: Decon Activities: Splits Taken:

Malcolm Pirnie Inc Field Representative Signature:

Printed Name: Douglas Auld

Total # of pages: 4 of 9

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008-CLRC-041	Northing: 702137 Easting: 585602	9/22/2008 Time: ✓ 0815

Name(s) of Contractor Samplers (Include Boat Captain Name): STEVE GADOMSKI, JAY DILORENZO } OSI; MIKE HAUSER, JEFF HOLZER } EHSE

Necessary information (specified in core collection SOP) recorded into the field notebook: ✓ Yes No (comment:)	Sampling locations agree with those specified in the QAPP/FSP: ✓ Yes No
Core advanced via: Pushing (piston/hand) ✓ Vibracore Other (comment):	Was the core tubing rinsed thoroughly between attempts? Yes No ✓ n/a
Was the vibracore motor turned on immediately after the core tube penetrated the sediment? ✓ Yes No	Was a core catcher used? If so, why? ✓ Yes No CORE CATCHER'S USED THROUGHOUT PROGRAM
Were multiple attempts made to advance the core? Yes ✓ No Comment:	Was a short core collected? ✓ Yes No DUPLICATE
	Short Core Designation: 2008-CLRC-041 C2 Northing: 702136.58 Easting: 585598.81 Offset from Target: 3.2

LPRRP-03a-Core Sampling

Total # of pages: 5 of 9

Core Attempt Chart

TSI Core ID #:

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (ft) FT.	Recovery Depth (ft) FT.	Recovery %	Disposition of attempt*
C1	702138.22	585602.76	1.3	3 5/8	core	Lex	5.5	5.5	100	F
C2	702136.58	585598.81	3.2	3 5/8	core	Lex	6.0	4.5	75	S
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

✓ Core Labeled ✓ Core Sealed ✓ Marked with "Up" ✓ Stored (iced, under tarp)

Deviations:

Correct decontamination procedures performed for field equipment (if applicable):

Proper decontamination solutions used — Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

BOTH CORES APPEAR TO BE COMPLETELY COMPRISED OF BLACK SILT TO TOTAL DEPTH. NATIVE MATERIAL (I.E., RED BROWN SAND/CLAY) NOT ENCOUNTERED.

Malcolm Pirnie Inc Oversight Staff's Name (printed):

Douglas Arndt

Oversight Staff's Signature

Date: 9/22/2008

Total # of pages: 6 of 9

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

GRAB SAMPLING

Sediment Grab Designation:	Target Sediment Grab Location:	Date:
2008-CLRG-041	Northing: 702137 Easting: 585602	9/22/2008 Time: 0930

Name(s) of Contractor Samplers (Include Boat Captain Name): Steve Gadomski, Jay Delorenzo } OSI; Mike Hauser, Jeff Holzer } ENSR

Necessary information (specified in grab collection SOP) recorded into the field notebooks: ✓Yes No (comment:)

Sampling locations agree with those specified in the QAPP/FSP? ✓Yes No

Identify the type of grab sampler used (*e.g.*, ponar dredge, van veen sampler, or box corer): Ponar dredge w/ stabilization frame

Was the sampler rinsed properly between multiple grab attempts at the same location? ✓Yes No n/a Comment:

Grab Attempt Chart

TSI Grab ID #:

Grab Attempts	Northing	Easting	Offset (ft)	Sample Type (grab/field blank)	Disposition of attempt*	Other Observations
G1	702133.51	585595.88	8.0	Grab	A	
G2	702130.32	585599.43	8.0	Grab	S	Silt BLF collected
G3	702132.29	585606.24	7.1	Grab	S	Silt VOC collected
Final						

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Total # of pages: 7 of 9

Confirm grab sample labeling and handling by checking appropriate boxes below:

✓ Top 1-inch layer removed for Be-7 analysis ✓ Remaining sample homogenized

✓ VOC collected ✓ Sample jars stored on ice

Deviations/Comments: UNABLE TO OBSERVE GRAB SAMPLE COLLECTION DUE TO TRANSFER BOAT TRANSPORTING CORES TO PROCESSING FACILITY

Correct decontamination procedures performed for field equipment (if applicable):

✓ Proper decontamination solutions used ✓ Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS AUVIL

Oversight Staff's Signature	Date:
	9/22/2008

Total # of pages: 8 of 9

Passaic River Study Area CPG Oversight Project
Remedial Investigation Sediment Sampling and Analysis

CORE SAMPLING

Sediment Core Designation:	Target Sediment Core Location:	Date:
2008-CRC-042	Northing: 702116 Easting: 585643	9/22/2008 Time: ~1100

Name(s) of Contractor Samplers (Include Boat Captain Name): Steve Gadomski, Jay Deshorch20 — Mike Haber, Jeff Holzer — Ensr

Necessary information (specified in core collection SOP) recorded into the field notebook:
☑ Yes ☐ No (comment:)

Sampling locations agree with those specified in the QAPP/FSP:
☑ Yes ☐ No

Core advanced via:
☐ Pushing (piston/hand) ☑ Vibracore
☐ Other (comment):

Was the core tubing rinsed thoroughly between attempts?
☐ Yes ☐ No ☑ n/a

Was the vibracore motor turned on immediately after the core tube penetrated the sediment?
☑ Yes ☐ No

Was a core catcher used? If so, why?
☑ Yes ☐ No

Were multiple attempts made to advance the core?
☐ Yes ☑ No Comment:

Was a short core collected?
☑ Yes ☐ No
Duplicate

Short Core Designation: 2008-CRC-042 C2

Northing: 702120.41

Easting: 585641.32

Offset from Target: 4.7

LPRRP-03a-Core Sampling

Total # of pages: 9 of 9

Core Attempt Chart

TSI Core ID #:

Core Attempts	Northing	Easting	Offset (ft)	Tube Diameter (in)	Sample Type (core/ grab/field blank)	Tube Material	Penetration Depth (by FT.)	Recovery Depth (by FT.)	Recovery %	Disposition of attempt*
C1	702117.08	5855942.78	1.1	3 5/8	CORE	LEX	6.0	4.4	73	S
C2	702120.41	5855941.32	4.7	3 5/8	CORE	LEX	6.0	6.2	103	S
Final										

*Disposition: R-Relocation/A-Abandoned/D-Disposed/
S-Save until complete/F-Final Saved

Confirm core labeling and handling by checking appropriate boxes below:

✓ Core Labeled ✓ Core Sealed ✓ Marked with "Up" ✓ Stored (iced, under tarp)

Deviations:

Correct decontamination procedures performed for field equipment (if applicable):

— Proper decontamination solutions used — Decontamination waste collected for proper disposal

Additional comments on sampling operations (if necessary):

ALL SEDIMENT APPEARS TO BE BLACK SILT. NO NATIVE MATERIAL (I.E.) RED/BROWN SAND, CLAY) ENCOUNTERED.

Malcolm Pirnie Inc Oversight Staff's Name (printed):

DOUGLAS AMO

Oversight Staff's Signature

Date: 9/22/2008

September 25 – CPG Oversight of portable Vibracore operations.

- Arrived at the CPG field facility at 7:20 AM
- Signed in the visitor log
- Attended a Health and Safety briefing and then signed the site safety log
- Received a brief tour of the facility and the sample processing area. Samples were not being processed at the time.
- Captain Al discussed with me the planned activities for the day
    - Vibracore sample collection at station locations: 93, 94, 91, and 92
    - Provided with a "track changes" copy of the September 16th version of the SOP for "Sediment Coring Using a Vibracorer".
    - Discussed that I would be on my own, that I should stay 10' from shore of the river, and call if I need assistance
- Drove to the river location where Station 93 and 94 were located. This is approximately at RM 16.5
    - Took Photographs and observed the Vibracore boat crew from the shore.
    - No Vibracore samples were retrieved from these two locations. An aluminum core tube, without a liner or core catcher, was used. A small "Little Champ" Vibracore was utilized. This consisted of an electric concrete vibrator clamped to the aluminum core tube. An onboard electric generator powered the vibrator. It appears that the procedures that were followed are those identified in 5.1.4 for two-person Vibracorer, although the samples were attempted from a boat which has specific SOP found in 5.1.3. I believe they used the 5.1.4 procedures instead of the 5.1.3 procedures was due to the fact that the project Vibracore vessel could not navigate into these shallow waters, nor navigate beneath the low clearance bridges. Deviations from this are listed below.
        - Crew indicated that there were a lot of rocks and the Vibracore could not penetrate this location
        - The vessel was relocated as stipulated in the SOP, however penetration was still unsuccessful due to the rocky conditions.
        - I was not aware if a Ponar dredge sample was successfully obtained or even attempted, although I was told that they had a Ponar dredge aboard in the event a Vibracore attempt was unsuccessful
    - The Vibracore tripod (tower) was not erected at these locations. The crew commented to me that the tripod would have been erected had the Vibracore penetration been successful. The tripod is necessary for retrieving the core tube from the sediment. The tripod was not erected prior to leaving the dock because the vessel needed to pass under low clearance bridges on its way to the proposed sampling locations.
- Drove to the river location where Station 91 and 92 were located. This is approximately at RM 16.0
    - Took photographs and observed the Vibracore boat crew from the shore, approximately 50-75 feet from the vessel, and also observed from the Monroe Street Bridge.
    - Vibracore sample was collected from Station 92

        - It appeared that deeper penetration of the core tube was prevented due to the concrete vibrator cable reaching the boat “moon pool”. Deeper penetration of approximately 18 inches may have been possible
        - A few attempts were made.
        - The tripod was erected at this location to assist with the retrieval of the core tube
        - At times the core sample fell from the core tube
        - Tube with sample was sounded to determine sample recovery
        - Water was drained from the tube by drilling a hole
        - Tube was cut using a pipe cutter
        - Sample was capped, taped, and labeled as specified in the SOP
    - Vibracore sample was attempted at Station 91. A sample was not able to be collected from this station
        - I could not assess whether a Ponar or scoop sample was attempted or collected
- Another CPG vessel was observed near this station. The crew of this vessel went to the train bridge next to the Monroe Street bridge and downloaded data from the HOBO prior to the next day’s forecasted storm
- Reported back to the field office to let them know I was OK
- Signed out at approximately 12:30
- Downloaded photographs (To be provided)

Deviations from the SOP:

- Aside from using the two-person Vibracore from a boat, the field crew appeared to follow the SOP. It is understood why this was necessary and should not be considered a deviation.
- No comment regarding Ponar, or sediment scoop, collection of sediments due to not witnessing this operation.
- Based on only one sample being collected, the Vibracore activities appeared to be acceptable

F. Chris Purkiss

Attachment B

Malcolm Pirnie, Inc. Progress Memorandum to EPA and USACE on Initial Oversight Observation of CPG Sediment Coring Program (dated August 12, 2008)

MALCOLM PIRNIE

Interoffice Correspondence

Date: August 12, 2008

To: Alice Yeh

Copy: Len Warner, Beth Buckrucker

From: Erika Zamek

Re: Summary Memo on LRC Oversight to Date

Oversight of Cooperating Parties Group (CPG) sediment probing, core collection, and core processing activities began on July 25, 2008. To date, a single deviation from the approved standard operating procedures has been observed: one core sample was not allowed to sit in the sediment for ten minutes prior to retrieval. This deviation was corrected in the field. While observed activities have, with the exception of the above, been in accordance with the approved procedures, oversight personnel have raised a few items that require discussion. These topics are described below.

Use of wire to divide core segments: Use of this method to divide the core segments results in a top-to-bottom smear zone down the center of the segment, creating the potential for cross-contamination along the entire length of the segment. Unlike the outer smear zone created during core collection, this inner smear zone is included in the material that is homogenized and sent for analysis.

While the surface area of the wire is small, and the amount of smearing caused by the wire alone is likely not significant, use of the method to divide segments where the core contains large-grained materials (*e.g.*, gravel or cobbles) creates a significant potential for cross-contamination. Coarse-grained particles within the segment could become caught on the wire and dragged such that cross-contamination of samples may be possible. The entrained rock or cobble could push along sediment ahead of it on the path through the segment, increasing the uncertainty in the interpretation of the data.

Split Sampling Coordination: To date, CPG core processing personnel have made every effort to accommodate the needs of Oversight personnel. The area where the needs of the two groups have been a challenge to reconcile is split sampling coordination. CPG personnel have been receptive to the need to collect split samples from the one-foot sections, but have indicated that collection of a third core (and potentially a fourth core) may be necessary to provide the sediment volume required by the two analytical programs for a one-foot section. This requirement may introduce greater uncertainty

into the coring data due to the spatial heterogeneity expected to be encountered, but it does not seem avoidable at this point.

In addition, the timing of processing activities makes the collection of split samples from a variety of locations difficult. Volatile organic compound (VOC) holding times dictate that split samples must be shipped on the day of collection, and use of Forms II Lite (required by the Contract Laboratory Program) adds significant time to the processing of split samples for shipment. Oversight personnel must leave the processing facility no later than 3 pm on days that split samples are collected in order to complete the paperwork and packing necessary for split samples to be shipped out the day of collection. The current CPG core processing schedule has activities starting around 11 am, leaving an approximate four-hour window for Oversight personnel to obtain split samples. This window allows the collection of splits from a single coring location each day, but not necessarily from multiple locations.

Sediment Probing Attempt Coordinates: Personnel conducting sediment probing oversight indicated that while the actual coordinates for probing locations were stored in the on-board GPS unit, probing personnel directed Oversight personnel to the target coordinates presented in the Quality Assurance Project Plan (QAPP) and would not provide the coordinates for locations where sediment probing was performed. It appears that this issue has been resolved for core collection activities. Oversight personnel have had no trouble obtaining the coordinates for successful and unsuccessful coring attempts.

Oversight of core processing from inside the tent: The initial days of core processing oversight were conducted from outside the tent. During the August 5 biweekly call, the Environmental Protection Agency directed that Oversight personnel should watch core processing from inside the tent. Tuesday, August 12, will be the first day where this will occur; any observations on the logistical difficulties (or lack thereof) should be discussed.

Use of core catchers: To date, core catcher use has been in accordance with the approved procedures. The CPG has encountered material at several different locations which could not be successfully collected without the use of a core catcher. The approved vibracore sampling procedure allows automatic usage of a core catcher in similar material for the duration of the program; use of this device should be monitored to ensure that when sampling activities move into more cohesive sediments, the use of core catchers is discontinued.

Please contact me at (914) 641-2961 with any questions regarding this information.

EKZ

Attachment C

Malcolm Pirnie, Inc. Quality Assurance Field Audit Report on 2008 Split Sample Collection (dated September 24, 2008)

QUALITY ASSURANCE (QA) FIELD AUDIT REPORT

Project: Lower Passaic River Restoration Project 2008 Sediment Corning CPG Oversight

Date of Audit: September 24, 2008

Project Address: Environmental Consultants and Engineers (ENSR)
Field Facility, 1 Madison Street, East Rutherford, NJ

Activities Audited: Sediment Processing Oversight, Split Sample Collection, and Shipment

Auditor's Name: Jim McCann

Phone: 201-398-4310

Personnel present during split sample collection at CPG Sample Processing Field Facility:

Name	Representing	Role
Carolyn Zeiner	Malcolm Pirnie, Inc.	Sample Processing Oversight and Split Sample Collection/Transfer
Don Boye	ENSR	Site Supervisor on duty and provider of Health and Safety Plan Review
Teresa Watson	ENSR	Geologist and lead person supervising the core processing and sampling
Paula Winchell	ENSR	ENSR Sample Management Office and Daily Briefing
Kristen Durocher	ENSR	Core processing and sampling
Jennifer Musella	ENSR	Core processing and sampling
Jennifer Reed	ENSR	Core processing and sampling

Personnel at the Malcolm Pirnie Inc., Fair Lawn, New Jersey Office packing/shipping the samples:

Name	Representing	Role
Carolyn Zeiner	Malcolm Pirnie, Inc.	Oversight Split Sample Transfer
Xiulan Wang	Malcolm Pirnie, Inc., at Fairlawn NJ office	Split Sample Management Office using Forms II Lite and sample packing
John Cole	Malcolm Pirnie, Inc. at Fairlawn NJ office	Split Sample packaging and drop-off at Fed Express

Auditor's Comments:

Overall, the oversight personnel adhered to the requirements of the procedures outlined in the Oversight Quality Assurance Project Plan (QAPP) (Malcolm Pirnie, Inc., 2008). Carolyn Zeiner carefully observed the samples processing, communicated effectively with the ENSR sample processing personnel and documented their actions during the sediment processing.

During the QA audit, samples were collected by the ENSR personnel, from co-located sediment cores collected early that morning. Carlyon Zeiner observed the sample processing in the restricted processing area which was inside an enclosed ventilated tent in the center of the field facility. The split samples were selected by the ENSR geologist with the agreement of Carolyn Zeiner, who documented the sample collection using the forms provided in the QAPP. There were no major problems or deviations observed during the collection of the split samples, but the following minor issues were noted:

1. Due to the soft consistency of the sediment being processed, the ENSR sampler encountered some difficulty filling the Encore samplers provided for the collection of the split samples for Volatile Organic Compound (VOC) analyses. To overcome the problem, she employed clean spoons to insure that the samplers were full. Consideration should be given to either providing alternate VOC sampler containers and or modifying the VOC collection procedure in the event that very soft sediments are encountered in the future.
2. Single 4 oz. jars were provided (labeled) for the collection of the split sample for both total petroleum hydrocarbon (TPH) and total organic carbon (TOC) analyses, since both tests are performed by Hampton Clarke. During the split sample collection, Teresa Watson, the ENSR geologist, mentioned that she did not intend to collect the ENSR samples for TOC and TPH from the same co-located cores. To insure that the split sample would be collected from the same homogenized core segment additional 4 oz. sample jars were obtained by the oversight

personnel. Separate split samples were collected for TOC and TPH from the same homogenized core segment sampled by ENSR. TPH and TOC split samples may have previously been collected by ENSR from different co-located core sections. This information would have been recorded on the previous week's oversight sampling forms and should to be considered when evaluation the split sample data. For the remaining split sample collection events arrangement were made to provide separate jars THP and TOC split sample analyses.

3. Field duplicate split samples have not been collected yet during the split sample program. Arrangements will be made with ENSR to provide sufficient material so field duplicated split samples during the next few weeks.

The following table documents observations made during the QC audit and additional comments, if necessary:

AUDIT CHECKLIST AND OBSERVATIONS			
Item	**Yes/No**	**Observations and Comments**	**Corrective Action**
Did the oversight personnel follow safe practices?	Yes	Upon arriving at site ENSR provided an orientation to the processing facility, including a safety overview. Personnel within the sample processing restricted area were required to wear personnel protective equipment at all times.	NA
Were the split samples homogenized prior to collection?	Yes	With the exception of the VOC samples, which were collected as grab samples, the samples were well homogenized with a spoon in a stainless steel bowl prior to collection.	NA
Item	**Yes/No**	**Observations and Comments**	**Corrective Action**
Did oversight personnel obtain the intended number of intended oversight samples?	Yes	All of the selected samples were provided.	NA
Were the required QC and field duplicate samples collected per the QAPP?	Yes	Field duplicates have not been collected yet and should be collected over the next few weeks.	NA

Were the split samples packed and properly preserved upon after collection and transfer?	Yes	The samples were placed in coolers packed with ice for transfer to the Malcolm Pirnie, Inc. office in Fair Lawn, New Jersey to be entered into the computer system using Forms II Lite software and for final packaging and shipment to the laboratories.	NA
Was documentation kept by oversight personnel of the sediment core processing and split sample collection?	Yes	QAPP Attachment 8, Oversight Forms were completed by the Malcolm Pirnie, Inc. oversight person.	NA
Was the Chain of Custody (COC) form properly completed documenting the transfer of the sediment samples custody to the oversight team?	Yes	The transfer COC was properly completed. A copy of the COC was also sent to the Malcolm Pirnie, Inc., Fair Lawn office. After all the samples were collected, the samples were transferred on ice in a cooler to the Malcolm Pirnie, Inc. Fair Lawn office where they were re-packaged in separate coolers for shipment to the appropriate individual laboratories.	NA
Item	**Yes/No**	**Observations and Comments**	**Corrective Action**
Was the sample information entered into Forms II Lite per the Oversight QAPP?	Yes	The information was properly entered into the computer at the Malcolm Pirnie, Inc. Fair Lawn office using the Forms II Lite by, Xiulan Wang who served as the sample management officer.	NA
Were the samples properly labeled?	Yes	The samples arrived at the Malcolm Pirnie, Inc. Fair Lawn office labeled using a water proof marking pen. New sample labels were printed using Forms II Lite and placed on each sample jar and covered with clear tape to protect them from moisture prior to	NA

		shipment to the labs.	
Were COC forms generated by Forms II Lite placed in each sample coolers?	Yes	The appropriate COC form protected in a plastic bags were taped to the inside cover of each cooler except in the case of cooler for Hampton Clarke which will be picked up by a courier.	NA
Were properly packaged, custody seals applied and the coolers properly sealed?	Yes	The samples were well packaged per the Oversight QAPP. Custody seals were applied to each sample and the coolers sealed with tape.	NA
Were the samples properly preserved before final shipment to the labs?	Yes	As much ice as possible was added to each cooler before they were sealed for final shipment to the individual laboratories.	NA
Were the samples successfully shipped?	Yes	Shipping paper work was properly completed. The sample coolers for the Axys Analytical and the USEPA assigned CLP labs were shipped that evening via Fed Express. The cooler with the samples for Hampton Clarke picked up by a courier supplied by the laboratory. The laboratories were notified of the sample shipments by Xiulan Wang via electronic mail.	NA

Attachment D

Malcolm Pirnie Split Sample Comparison of 2008 CPG Sediment Coring Data (dated October 5, 2009)

MALCOLM PIRNIE

Correspondence

Date: October 5, 2009

To: Alice Yeh (USEPA)
Elizabeth Buckrucker (USACE)

From: Malcolm Pirnie, Inc.

Re: Statistical Comparison of 2008 Low Resolution Split Sample Sediment Data
Lower Passaic River Restoration Project
W912DQ-08-D-0017, Task Order 0010

Summary

This memo presents the results of a comparison between samples from the Cooperating Parties Group (CPG) 2008 Low Resolution Coring Program and split samples collected by Malcolm Pirnie for U.S. Environmental Protection Agency's (USEPA's) oversight effort. Overall, significant and substantial biases were observed for dioxins/furans (except for OCDF), TOC and PAHs (except for Anthracene). In particular, for 2,3,7,8-TCDD, which is a major risk driver in the Lower Passaic River, the CPG concentrations were significantly lower compared to corresponding USEPA split samples. For TOC, which is a constituent of importance with respect to organic chemical fate and transport, the concentrations reported for the CPG samples were significantly higher than those reported for USEPA split samples. The median differences in PAHs were greater than 20 percent in almost all chemicals analyzed. Differences in PCBs, pesticides and metals concentrations were generally within 20 percent; however in some cases these differences were found to be statistically significant.

Introduction

The CPG 2008 low resolution sediment coring program consisted of 126 sediment core locations from river mile (RM) 0 at the confluence of the Lower Passaic River and Newark Bay to RM17.4 at the Dundee Dam. Cores were segmented systematically with the following scheme: 0-0.5 foot (slice A), 0.5-1.5 feet (slice B), 1.5-2.5 feet (slice C), 2.5-3.5 feet (slice D), and then 2-foot segments to the core bottom. Government oversight split samples (herein referred to as "USEPA split samples") were collected from 4 percent of the CPG samples, yielding 30 split samples plus two field duplicates. The purpose of the split sample program was to provide an independent analytical dataset that can be compared to the CPG samples to investigate precision, accuracy, and potential bias.

The sediment samples were analyzed for selected chemicals of potential concern (COPCs), and chemicals of potential ecological concern (COPECs) including: dioxins/furans, polychlorinated biphenyls (PCBs), semi-volatile organic compounds including polyaromatic hydrocarbons (PAHs), pesticides including dichlorodiphenyltricholoroethane (DDT), and metals. In addition, all samples were analyzed for total organic carbon (TOC) content.

The objective of this analysis was to evaluate whether a bias exists between the CPG and USEPA split sample data by statistically comparing the split sample results for selected compounds from the various COPC and COPEC chemical groups.

Methodology

The comparison of paired data sets for measurement bias can be done by graphical methods to visualize the differences, as well as by formal statistical tests to determine if the paired differences are significant. Both methods were used in this analysis. Note that ordinary linear regression analysis was not considered because both data sets are subject to errors, and this is a direct violation of one of the ordinary linear regression assumptions. Furthermore, because the chemical concentrations are not normally distributed, non-parametric methods were selected to test for significant differences in data pairs and to estimate the differences. Although normality may be achieved by power transformations and the parametric t-test performed on the power transformed data, it may then become difficult to translate the results back to the original units.

Three different graphical methods were used to display the data sets, including:

- Line plots of absolute concentration for the various paired samples - a line plot provides insight on the relative magnitudes and patterns of concentrations measured by both analytical programs for each paired sample.
- Scatter plots of the measured concentrations - a scatter plot illustrates the relationship between the CPG samples and USEPA split samples, and in particular, reveals any bias based on the scatter of points above or below the 1-to-1 line.
- Bland-Altman plot (Bland & Altman, 1986 and 1999) - a type of plot typically used in analytical chemistry and biostatistics to analyze the agreement between two different assays. It is a graphical method in which the point differences (or alternatively percent difference or ratios) between the two data sets are plotted against the point averages of the two data sets. In this analysis, the differences in concentrations between CPG samples and USEPA split samples were not used because of increases in the variability and magnitude of the differences as the magnitude of the measurements increases. Instead, the ratios of the point measurements were plotted with a horizontal line drawn at the mean ratio for comparison to the ideal ratio of 1. In addition, for 2,3,7,8-TCDD and total tetra-dioxin, uncertainty is denoted by the lower confidence limit (LCL) and upper confidence limit (UCL) of the mean ratio. The LCL and UCL of the mean ratio for

2,3,7,8-TCDD and total tetra-dioxin were determined by the non-parametric bootstrap technique. The LCL and UCL were only calculated for 2,3,7,8-TCDD and total tetra-dioxin due to project schedule and budget constraints.

The closeness of the agreement among the individual measurements was assessed using formal statistical testing of the difference between paired data points. In this analysis, the non-parametric method called the Wilcoxon signed-ranks test was used to determine whether the USEPA split sample data are significantly different from the CPG data. Because there is an increasing difference between the data and the 1-to-1 reference line as concentrations for all chemicals increase, multiplicative differences between the CPG and USEPA split sample concentrations can be inferred. These multiplicative differences would require a logarithmic transformation to produce differences which were symmetric before the Wilcoxon signed-ranks test could be performed. The test results are reported as probability values (p-values), where p-values less than 0.05 and 0.01 are interpreted as a significant difference between the two data sets at the 95 and 99 percent confidence levels, respectively. In addition, the median differences between CPG and USEPA split sample concentrations were determined based on the Hodges-Lehmann robust estimator (Δ) as follows:

1) For each of the N pairs of data estimate the difference *d* between the logarithmic transformed CPG and USEPA split sample concentrations ($d_i = \text{Log } x_i - \text{Log } y_i$, i=1, 2,…, N),
2) Form all possible ordered pairs of differences (d_i, d_j) with $i \leq j$. There are $N(N + 1)/2$ such ordered pairs.
3) For each of the above ordered pairs, compute the average value ($d_i + d_j$) /2.
4) The point estimate of the median difference can be obtained by med $i \leq j$ [(di + dj) /2]. The Hodges-Lehmann robust estimator (Δ) is the anti-log of this median estimate.

The Hodges-Lehmann robust estimator (Δ) should be interpreted as "CPG sample concentration = Δ * USEPA split sample concentration". Therefore, the farther from unity (*i.e.*, a value of 1) the Hodges-Lehmann robust estimator (Δ) is, the more of a difference there is between the CPG sample concentration and the USEPA split sample concentration.

Note that the three graphical methods, the statistical test of difference, and the Δ, must be considered together in a weight-of-evidence manner, because any one method or test may be subject to the influence of outliers or artificial plotting limitations. For example, in some cases, the scatter plot may be visually compressed due to differing x-axis and y-axis lengths, so that it may be difficult to see the number of points above or below the 1-to-1 line. In those cases, the Bland-Altman plot may better show scatter above or below the ratio-of-one line, because the ratios vary by less than an order of magnitude. In other cases, the mean ratio specified in the Bland-Altman plot may be skewed by a single high value, which may pull the mean ratio line closer to unity, in which case the robust Δ

estimator and the Wilcoxon signed-ranks test provide a better inference on the difference between the concentrations.

For each chemical group the data were pre-processed before the graphical and statistical analyses were performed as follows:

- Dioxin and furans – data were restricted to those samples where the reported concentration is five times the sample-specific quantitation limit or greater. This restriction on the data eliminates results that are classified as non-detected concentrations or may be estimated at low concentrations. The chemicals detected above this threshold in at least 14 split sample pairs were selected for evaluation including: 2,3,7,8-TCDD, total tetra-dioxins, 2,3,7,8-TCDF, 1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8-HpCDF, OCDD, OCDF, total tetra-furans, total penta-furans, total hexa-dioxins, total hexa-furans, total hepta-dioxins, and total hepta-furans.
- PCBs – All PCB homologues and total PCBs were selected for comparison. Six PCB congeners were also examined to represent the trichloro to octachlorohomologue groups, respectively: PCB-18 (2,2',5-trichlorobiphenyl), PCB-52 (2,2',5,5'-tetrachlorobiphenyl), PCB-110 (2,3,3',4',6-pentachlorobiphenyl), PCB-153 (2,2',4,4',5,5'-hexachlorobiphenyl), PCB-187 (2,2',3,4',5,5',6-heptachlorobiphenyl), and PCB-195 (2,2',3,3',4,4',5,6-octachlorobiphenyl). Furthermore, PCB 31, PCB 77, PCB 105, and PCB 118, which are congeners being modeled to examine future surface sediment concentrations, were also considered. For all PCB congener data, only samples where the reported concentration is five times the sample-specific quantitation limit were considered.
- PAHs – Selected chemicals representing low molecular weight (LMW) PAHs (including: anthracene, naphthalene and phenantrene) and high molecular weight (HMW) PAHs (including: benz[a]anthracene, benzo[a]pyrene, chrysene, fluoranthene, indeno[1,2,3-cd]pyrene and pyrene) were analyzed. For all the PAH chemicals, only samples where the reported concentration is five times the sample-specific quantitation limit were considered.
- Pesticides – The pesticides considered in the evaluation include: DDT and its metabolites (2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT), dieldrin, and gamma-chlordane. Due to the relatively high sample-specific quantitation limit for these chemicals, restricting the data to those where the reported concentration is five times the sample-specific quantitation limit would have resulted in very few matched pairs for comparison. Therefore, for these pesticides, all concentrations that were not flagged as non-detect by the lab or data validator were directly used for the split sample comparison. Inclusion of all these data, particularly at lower concentrations, will result in a scatter of the data and likely affect statistical test results.
- Metals and TOC – Metals selected included arsenic, barium, chromium, cobalt, copper, lead, mercury, nickel, and zinc, which were used as part of the empirical mass balance (EMB) formulation. For these metals, as well as TOC, only samples

where the reported concentration is five times the sample-specific quantitation limit were considered.

Results

Dioxin/Furan

- Line plots (Figures 1a through 13a), scatter plots (Figures 1b through 13b) and Bland-Altman plots (Figures 1c through 13c) indicate that the USEPA split sample data are systematically higher than the CPG data for all constituents, except OCDF.
- With the exception of OCDF, the paired results predominantly lie below the 1-to-1 line on the scatter plots, and below the ratio of 1 in the Bland-Altman plots. For 2,3,7,8-TCDD and total tetra-dioxins, the LCL and UCL interval of the mean ratio lies below the ideal ratio of 1 and the majority of the ratios fall outside the LCL and UCL interval (Figure 1c and 2c). This indicates that those data sets not only have a low bias, but also are not precise.
- The Wilcoxon signed-ranks test (Table 1) suggests significant differences between CPG and USEPA data for all dioxin/furan chemicals analyzed except for OCDF. The Hodges-Lehmann estimator indicate the most bias occurs for 2,3,7,8-TCDD and total tetra–dioxins results, and the differences between the data sets are significant at the 99 percent level of confidence.

PCBs

- The PCB homologues and congeners evaluated show differing agreements between the two data sets (Figures 14 through 33; Table 1). In cases where the Wilcoxon signed-ranks test showed statistical significant differences with 95 percent confidence, the differences are mostly within 20 percent, except for PCB 77, total monochlobiphenyls, and total dichlobiphenyls, for which differences are within 30 percent.

PAHs

- The PAH chemicals evaluated show systematic bias at the 95 percent confidence level, and median differences that are mostly greater than 20 percent (table 1). Scatter plots and Bland-Altman plots (Figure 34 through 42) showed varying degrees of deviation below the 1-to-1 line or the ratio of 1 line for the majority of the data pairs.

Pesticides

- The pesticides evaluated show tremendous scatter around the 1-to-1 line in scatter plots or ratio-of-1 line in Bland-Altman plots (Figure 43 through 50). Wilcoxon signed-ranks test indicate no statistical significant difference between the data sets (Table 1). However, the Hodges-Lehman estimator is extremely low for 2,4'-DDT, an indication of the precision issues for this chemical.

Metals

- As for PCBs, comparisons of split samples for metals show differing agreements between the two data sets (Figure 50 through 59). Although the differences between the data sets are generally within 20 percent, these differences are statistically significant at 95 percent level of confidence for barium, cobalt, copper, chromium, mercury and zinc.

TOC

- Concentrations of TOC measured by the CPG are significantly biased high by more than a factor of 2 compared to concentrations reported for the USEPA split samples (Figure 60; Table 1).

References

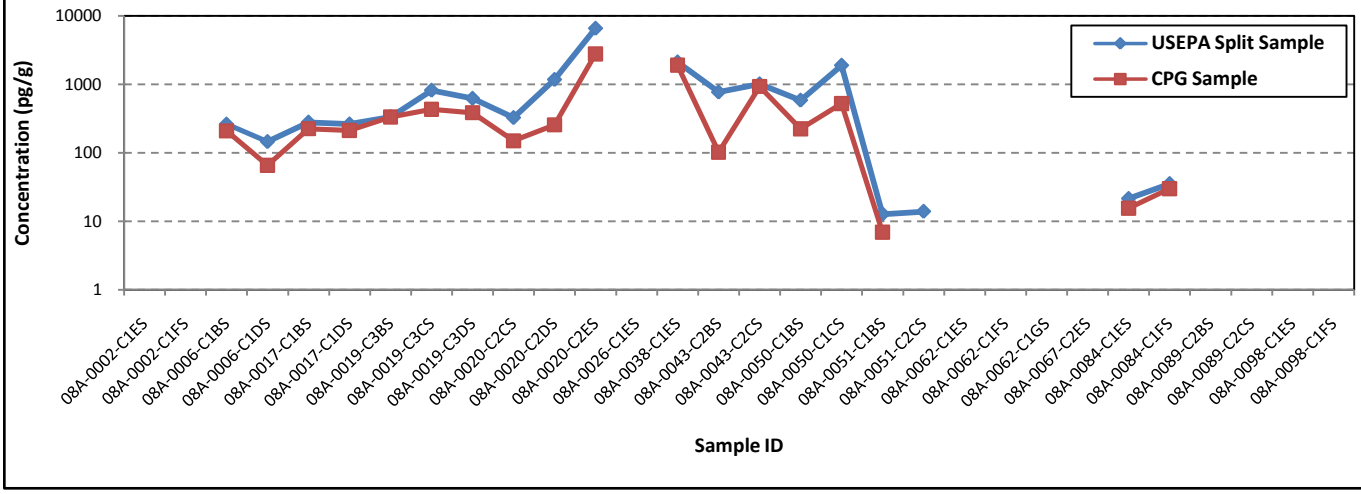
Bland JM, Altman DG (1986). Statistical method for assessing agreement between two methods of clinical measurement. The Lancet, i, 307-310.

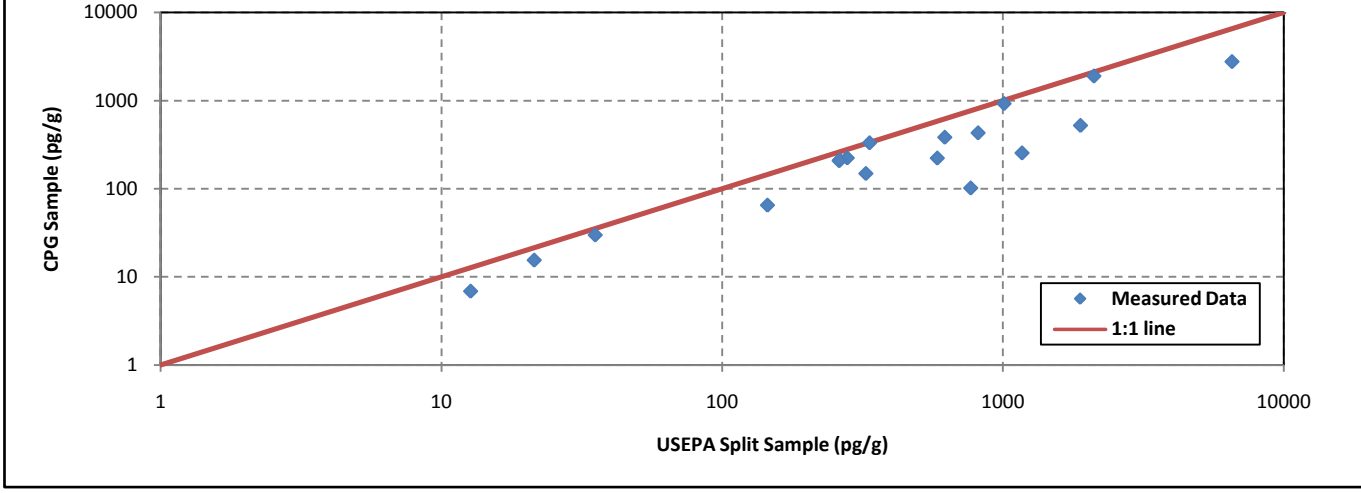
Bland JM, Altman DG (1999). Measuring agreement in method comparison studies. Statistical Methods in Medical Research, 8, 135-160.

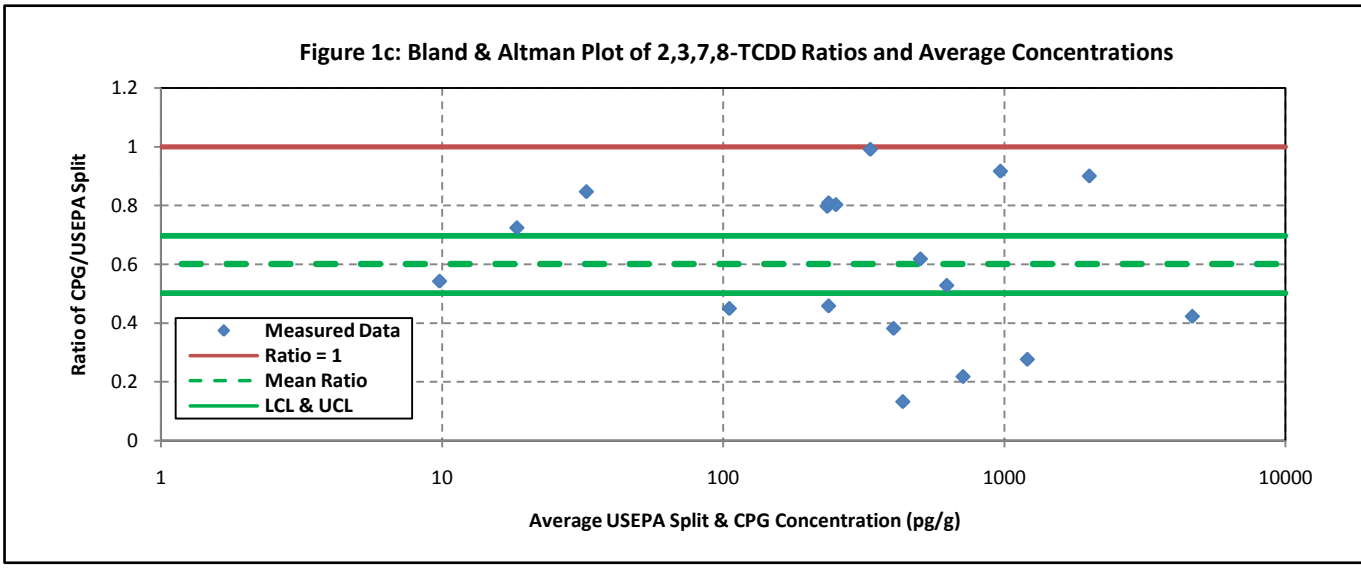
Table 1. Wilcoxon Signed Rank Test Results and Hodges-Lehmann Estimator				
Parameter	**Analyte**	**p-value**	**Significantly different?**	**Hodges Lehmann Estimator (Δ)[1]**
Metals	Arsenic	0.054	No	0.930
	Zinc	0.020	Yes	1.074
	Nickel	<0.001	Yes	1.150
	Mercury	0.044	Yes	1.156
	Lead	0.128	No	1.097
	Copper	<0.001	Yes	1.128
	Cobalt	<0.001	Yes	1.137
	Chromium	<0.001	Yes	1.208
	Barium	0.034	Yes	1.082
Dioxins/Furans	2,3,7,8-TCDD	<0.001	Yes	0.579
	Total TCDD	<0.001	Yes	0.545
	2,,3,7,8-TCDF	0.026	Yes	0.753
	1,2,3,4,6,7,8-HpCDD	0.008	Yes	0.805
	1,2,3,4,6,7,8-HpCDF	0.044	Yes	0.798
	OCDD	0.023	Yes	0.798
	OCDF	0.056	No	0.802
	Total TCDF	0.002	Yes	0.727
	Total Penta-Furans	0.001	Yes	0.718
	Total Hexa-Dioxins	0.001	Yes	0.769
	Total Hexa-Furans	0.001	Yes	0.691
	Total Hepta-Dioxins	0.010	Yes	0.720
	Total Hepta-Furans	0.004	Yes	0.707
PAHs	Benzo[a]pyrene	0.015	Yes	0.736
	Fluoranthene	<0.001	Yes	0.561
	Anthracene	0.054	No	0.790
	Phenanthrene	0.022	Yes	0.769
	Pyrene	0.001	Yes	0.604
	Benz[a]anthracene	0.010	Yes	0.655
	Chrysene	0.012	Yes	0.713
	Indeno(1,2,3-c,d)pyrene	0.002	Yes	0.671
	Naphthalene	0.008	Yes	0.840
PCBs	PCB 18	0.059	No	0.972
	PCB 31	0.006	Yes	0.851
	PCB 52	0.287	No	0.980
	PCB 77	0.001	Yes	0.710
	PCB 105	0.000	Yes	0.863
	PCB 110	0.783	No	0.976
	PCB 118	0.000	Yes	0.863
	PCB 153	0.059	No	0.931
	PCB 187	0.010	Yes	0.878
	PCB 195	0.695	No	1.024
	Total Monochlorobiphenyls	0.008	Yes	0.726
	Total Dichlorobiphenyls	<0.001	Yes	0.746
	Total Trichlorobiphenyls	0.000	Yes	0.818
	Total Tetrachlorobiphenyls	0.000	Yes	0.887
	Total Pentachlorobiphenyls	0.006	Yes	0.888
	Total Hexachlorobiphenyls	0.059	No	0.934
	Total Heptachlorobiphenyls	0.034	Yes	0.910
	Total Octachlorobiphenyls	0.253	No	0.841
	Total Nonachlorobiphenyls	0.044	Yes	0.852
	Total PCBs	<0.001	Yes	0.863
Pesticides	2,4'-DDD	0.205	No	0.900
	2,4'-DDE	0.372	No	0.948
	2,4'-DDT	0.088	No	0.547
	4,4'-DDD	0.189	No	0.864
	4,4'-DDE	0.346	No	1.079
	4,4'-DDT	0.351	No	0.840
	Dieldrin	0.411	No	1.048
	Gamma-Chlordane	0.170	No	1.121
TOC	Total Organic Carbon	<0.001	Yes	2.279

Note: Cells highlighted in yellow are statistically significant at 95 percent confidence level.

[1] The Hodges-Lehmann robust estimator (Δ) should be interpreted as "CPG sample concentration = Δ * USEPA split sample concentration"



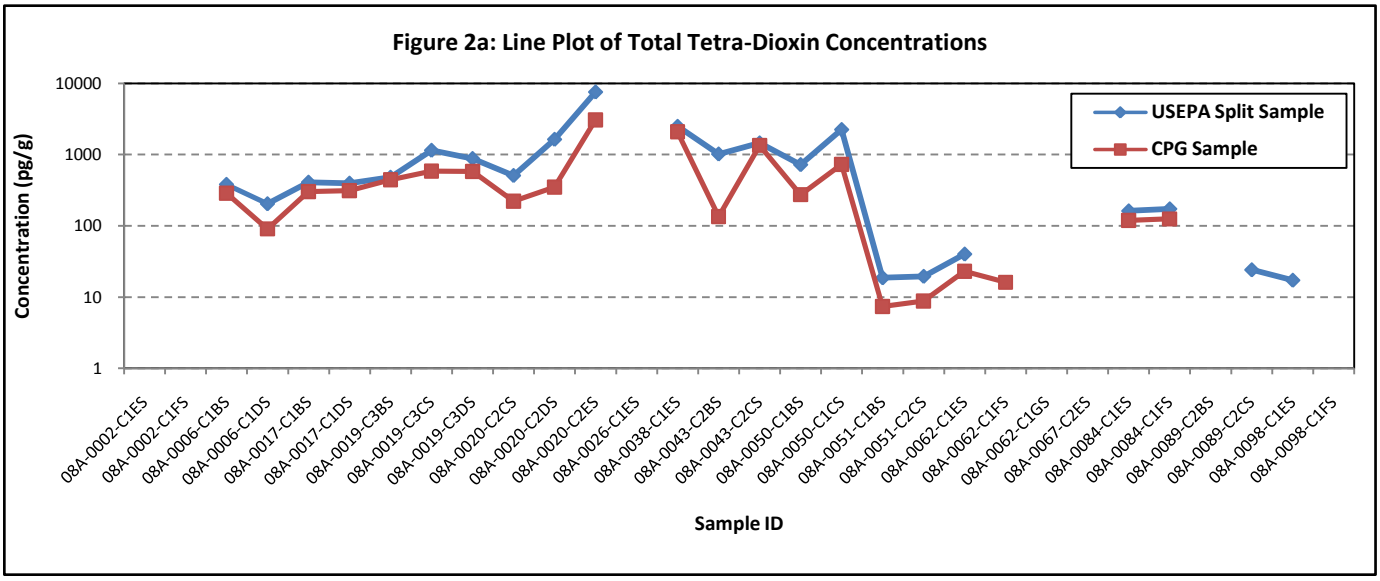


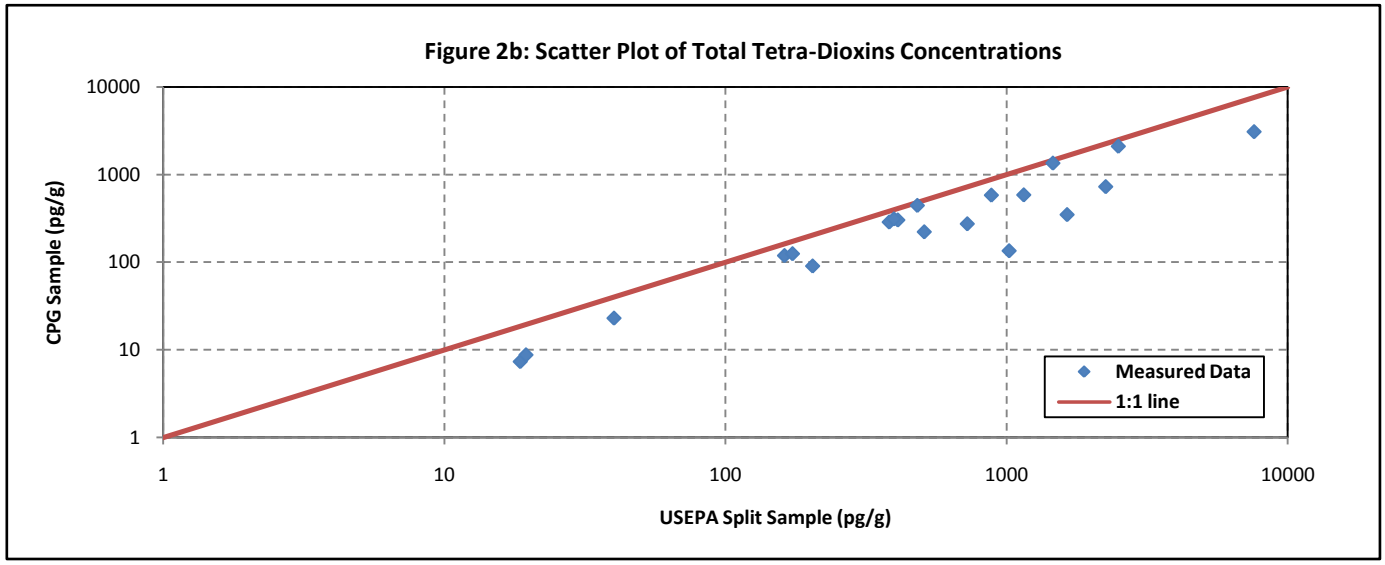


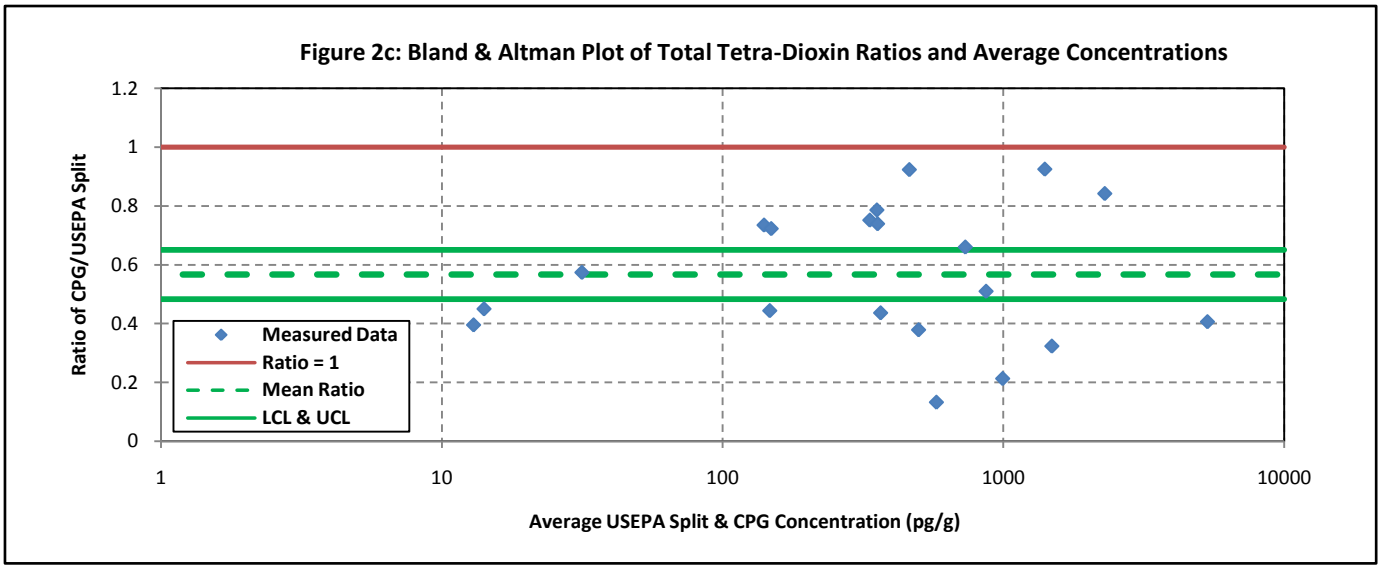
US Army Corps of Engineers®

Statistical Plots of 2,3,7,8-TCDD Concentrations

Figure 1







US Army Corps of Engineers	**Statistical Plots of Total Tetra-Dioxins Concentrations**	**Figure 2**

Figure 3a: Line Plot of 2,3,7,8-TCDF Concentrations

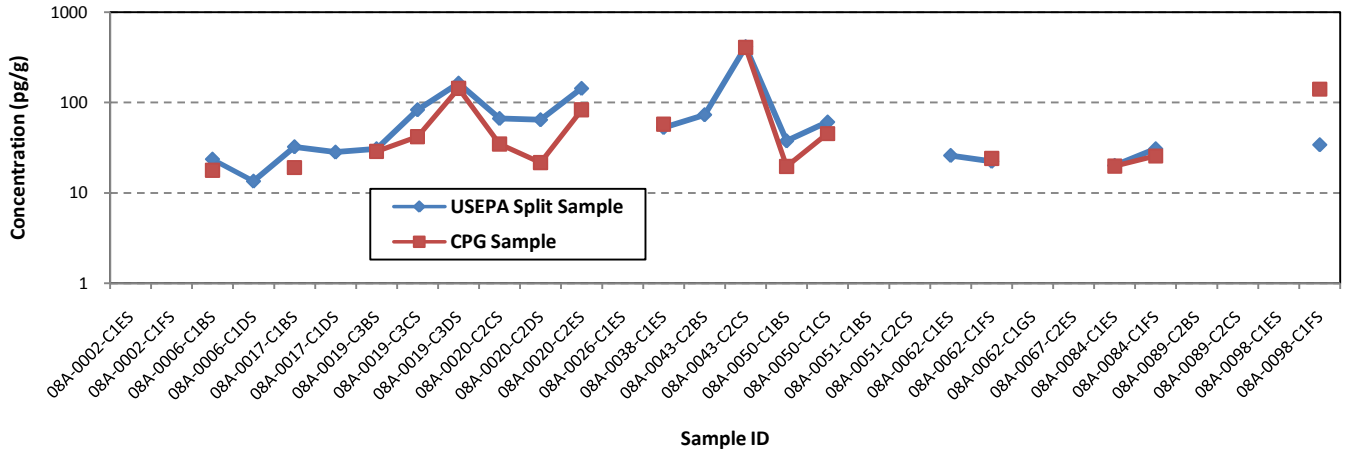


Figure 3b: Scatter Plot of 2,3,7,8-TCDF Concentrations

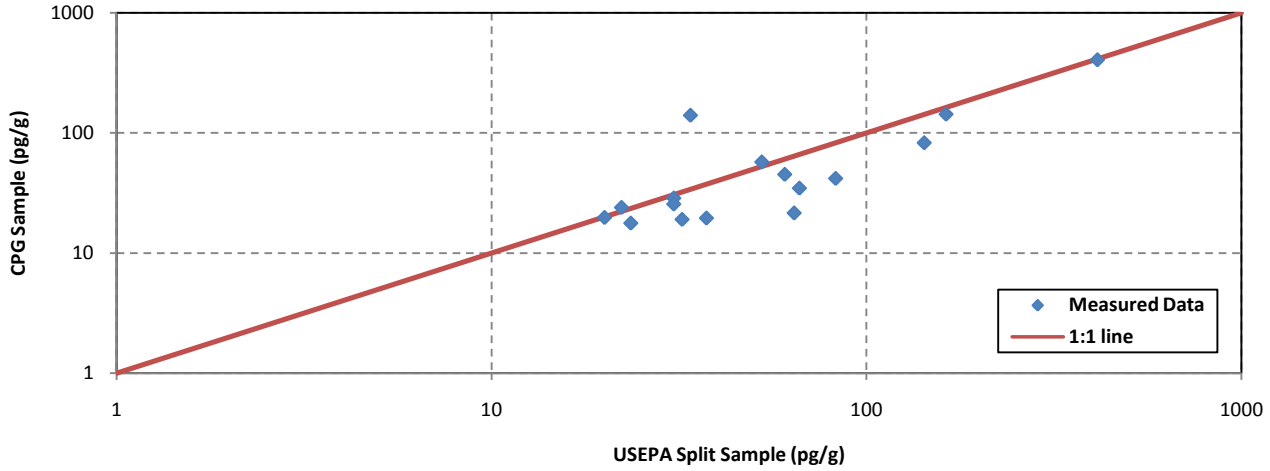
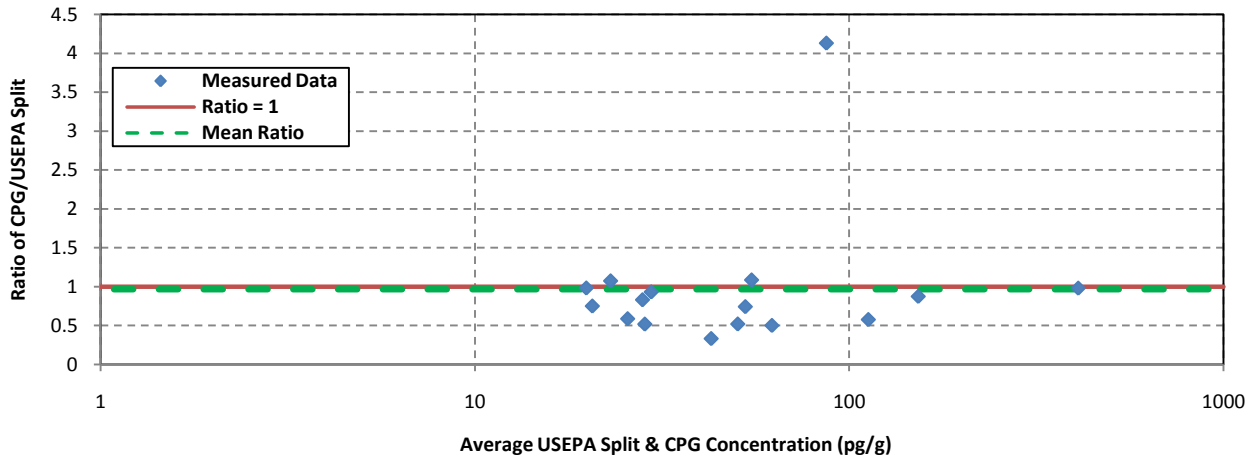
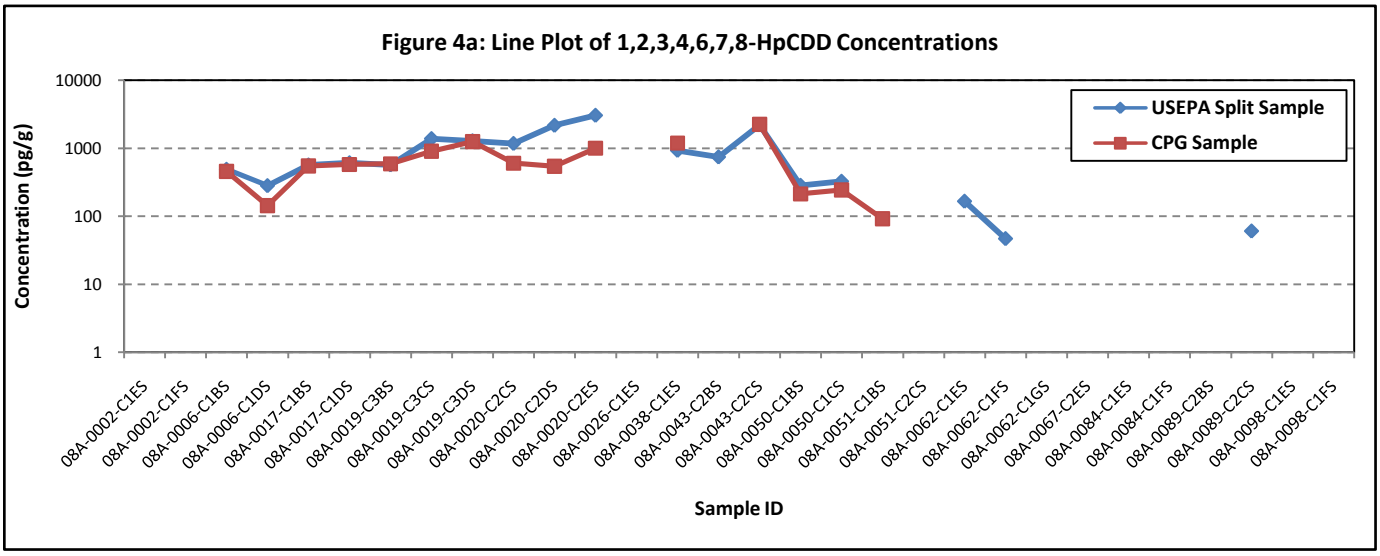
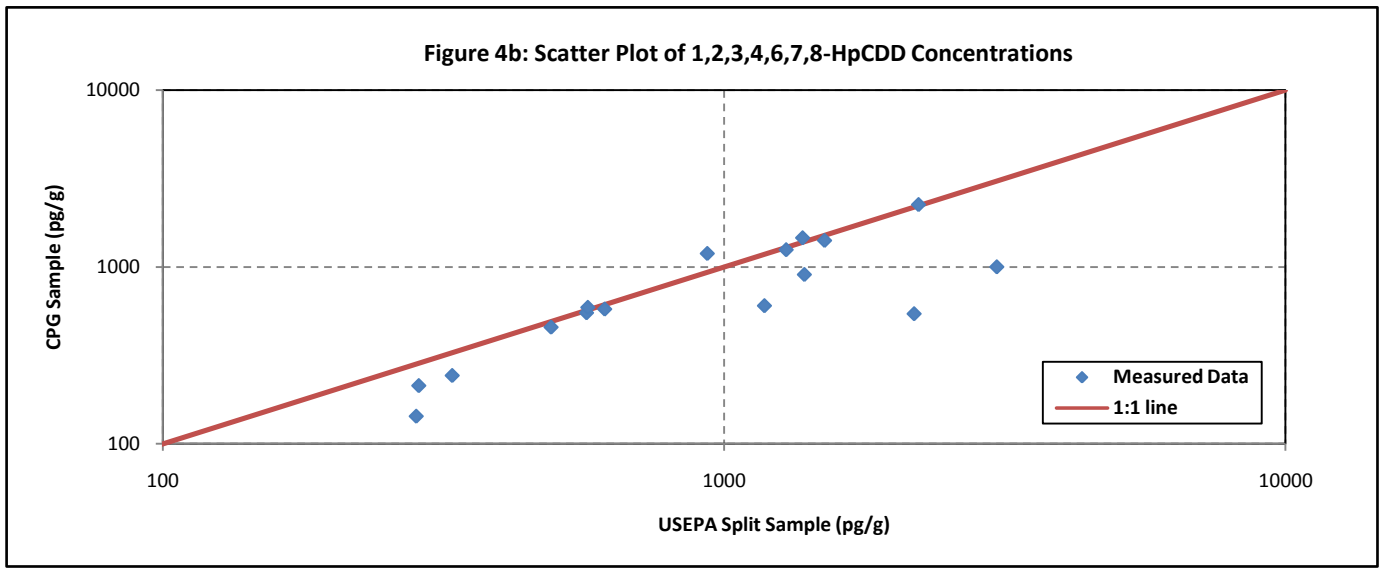
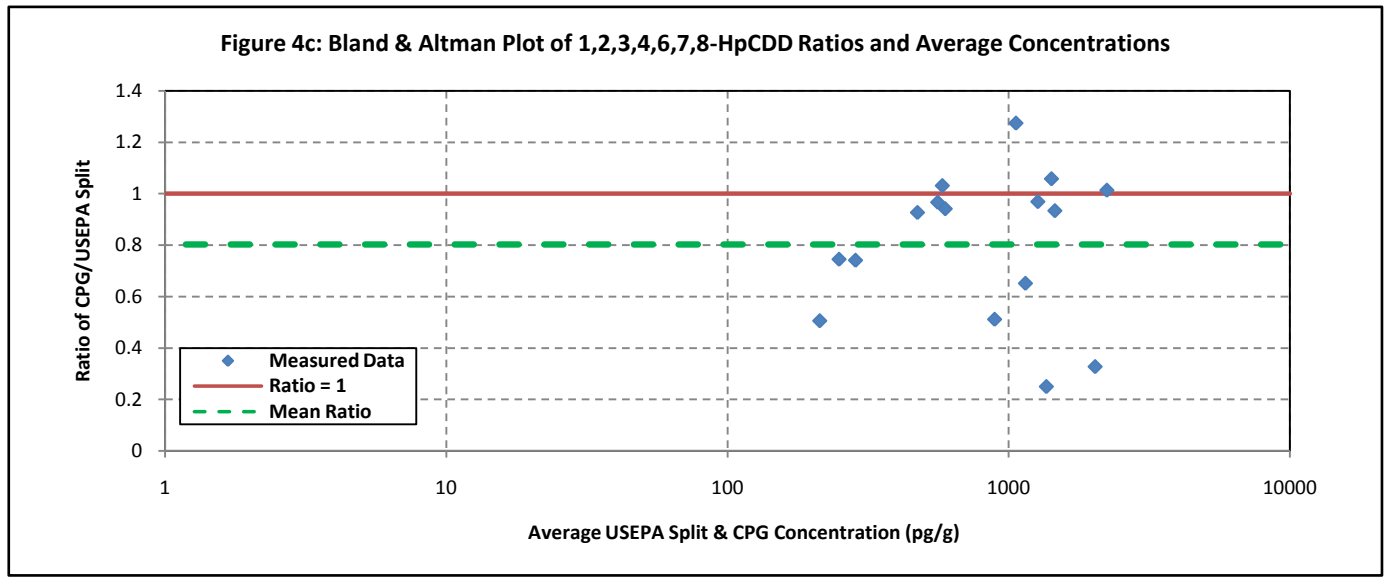


Figure 3c: Bland & Altman Plot of 2,3,7,8-TCDF Ratios and Average Concentrations





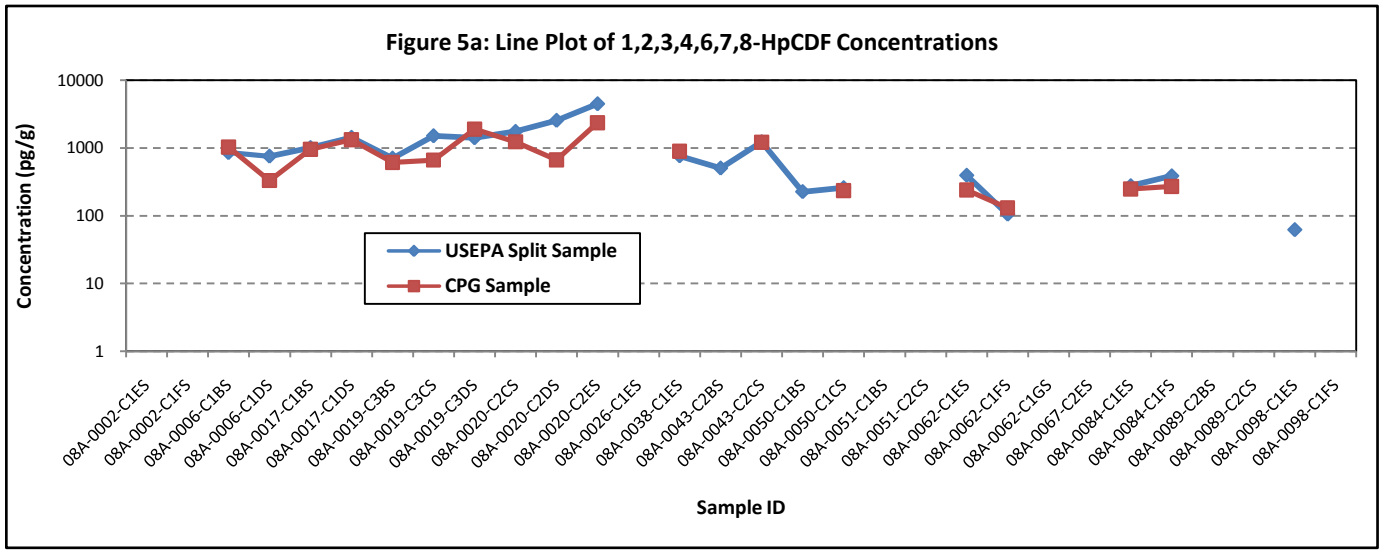


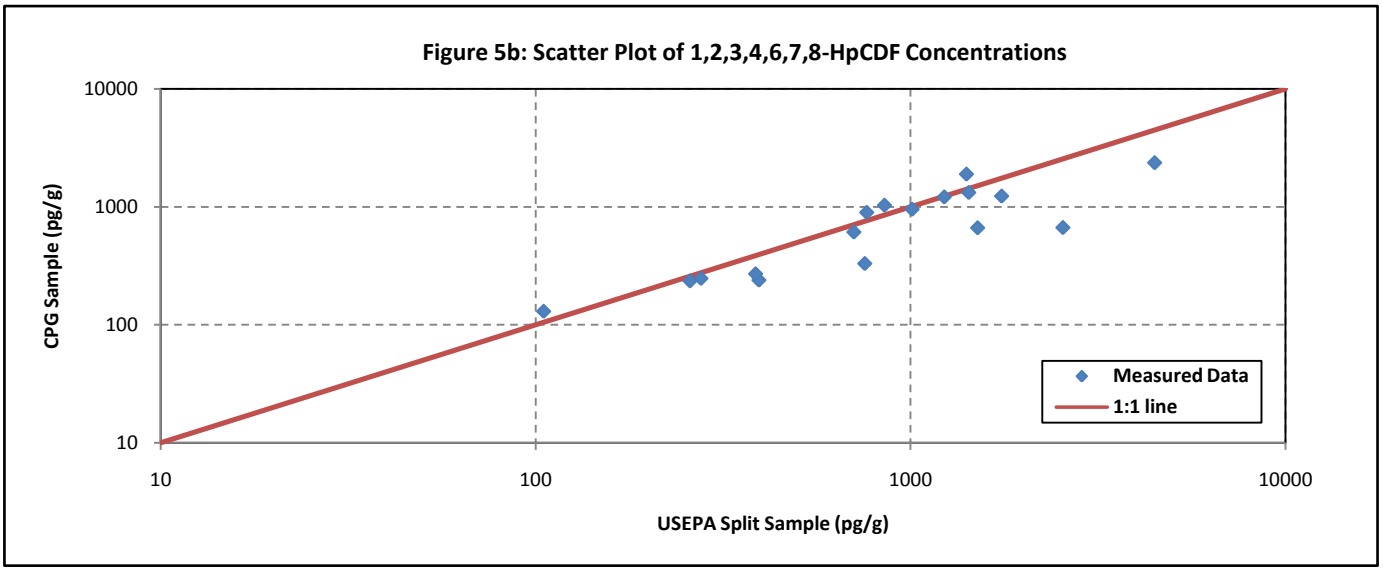


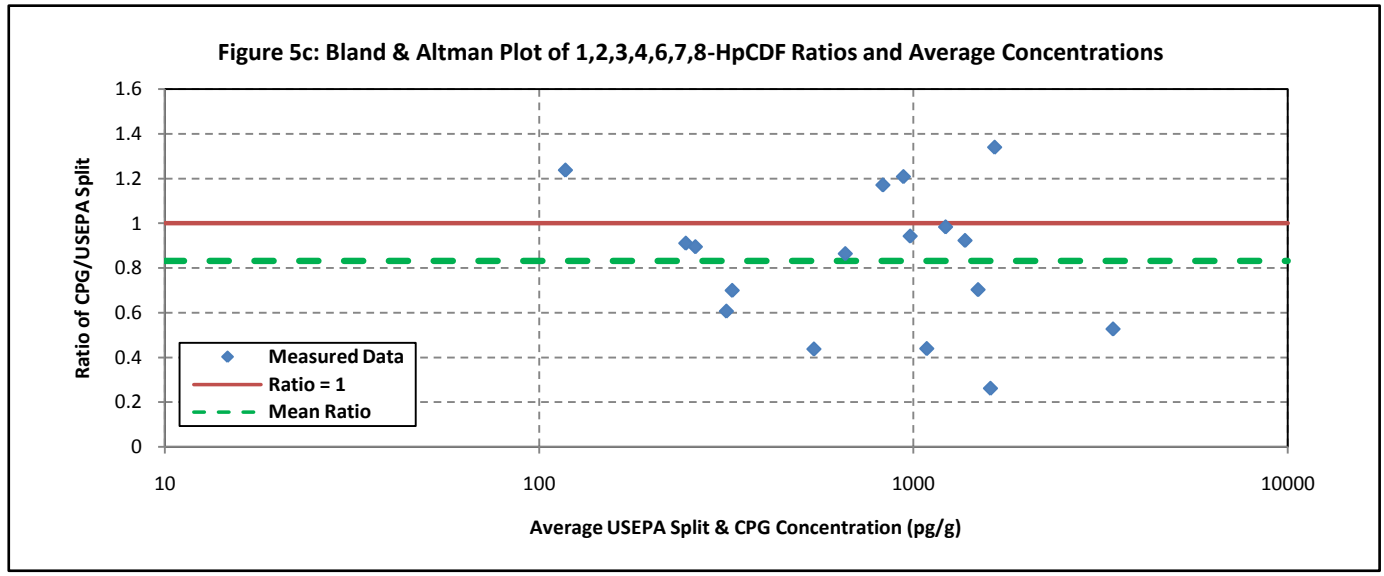
US Army Corps of Engineers®

Statistical Plots of 1,2,3,4,6,7,8-HpCDD Concentrations

Figure 4







US Army Corps of Engineers®	**Statistical Plots of 1,2,3,4,6,7,8-HpCDF Concentrations**	**Figure 5**

Figure 6a: Line Plot of OCDD Concentrations

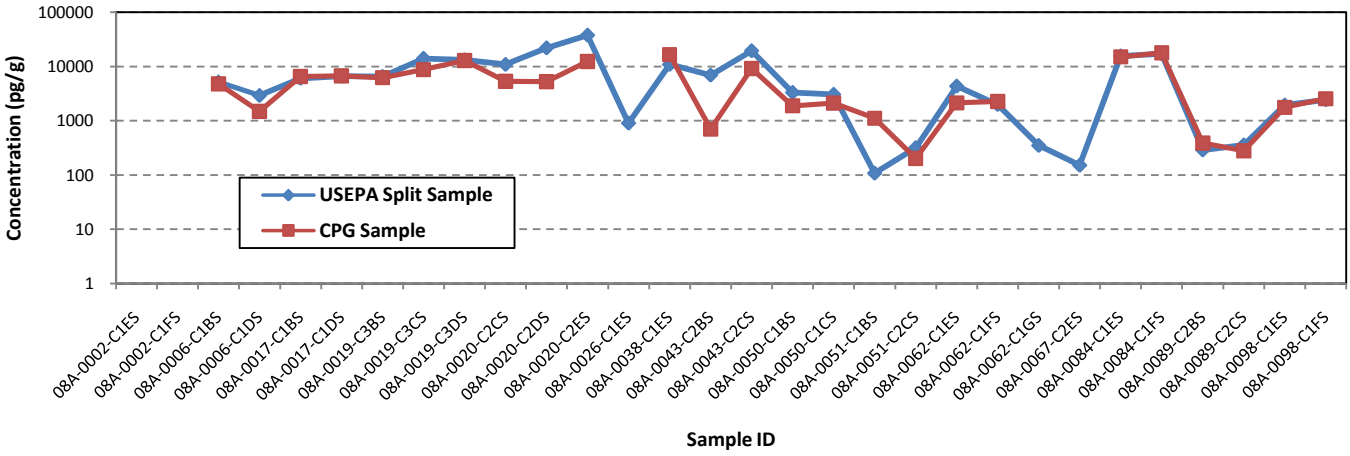


Figure 6b: Scatter Plot of OCDD Concentrations

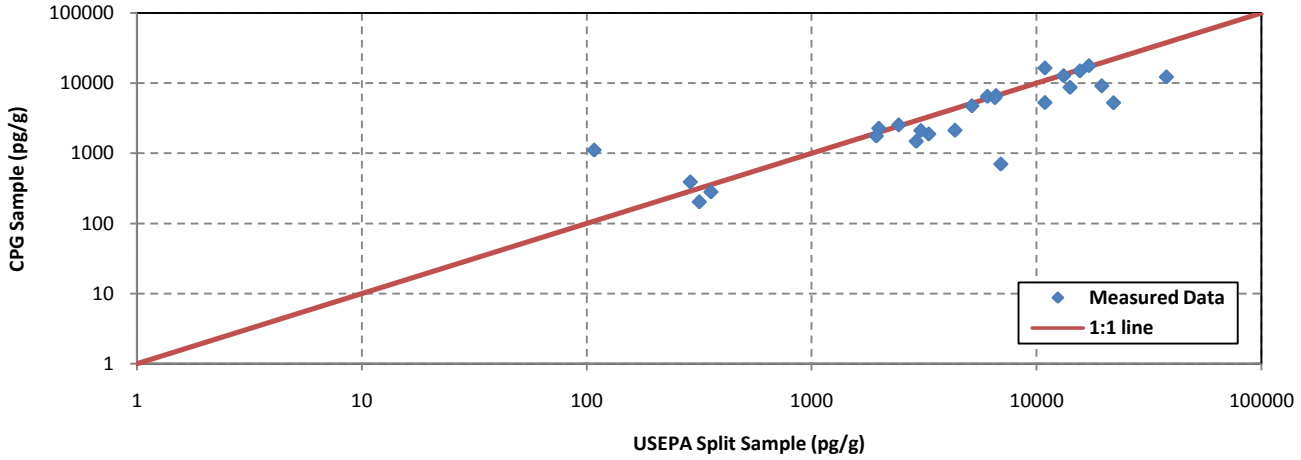
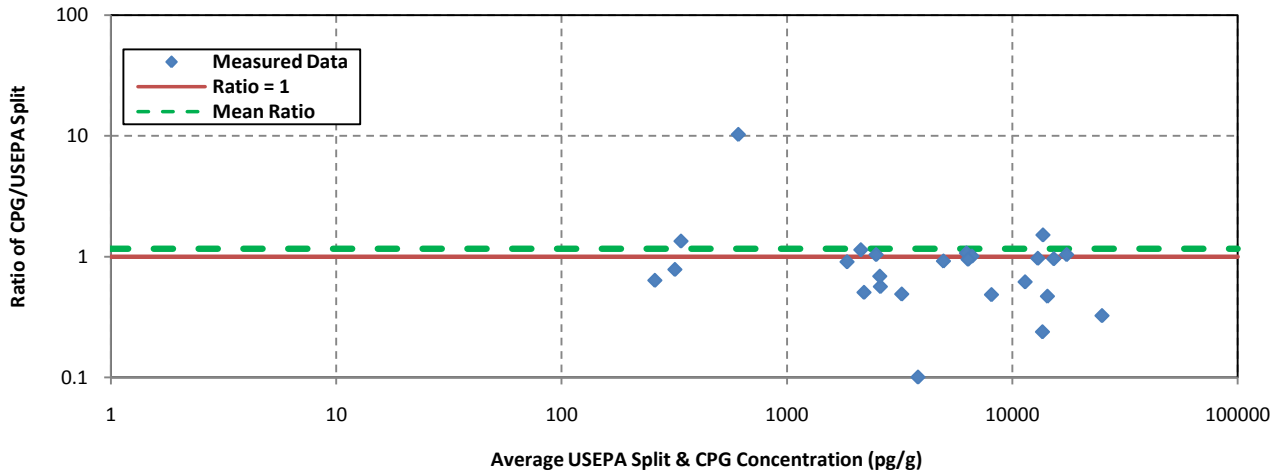


Figure 6c: Bland & Altman Plot of OCDD Ratios and Average Concentrations



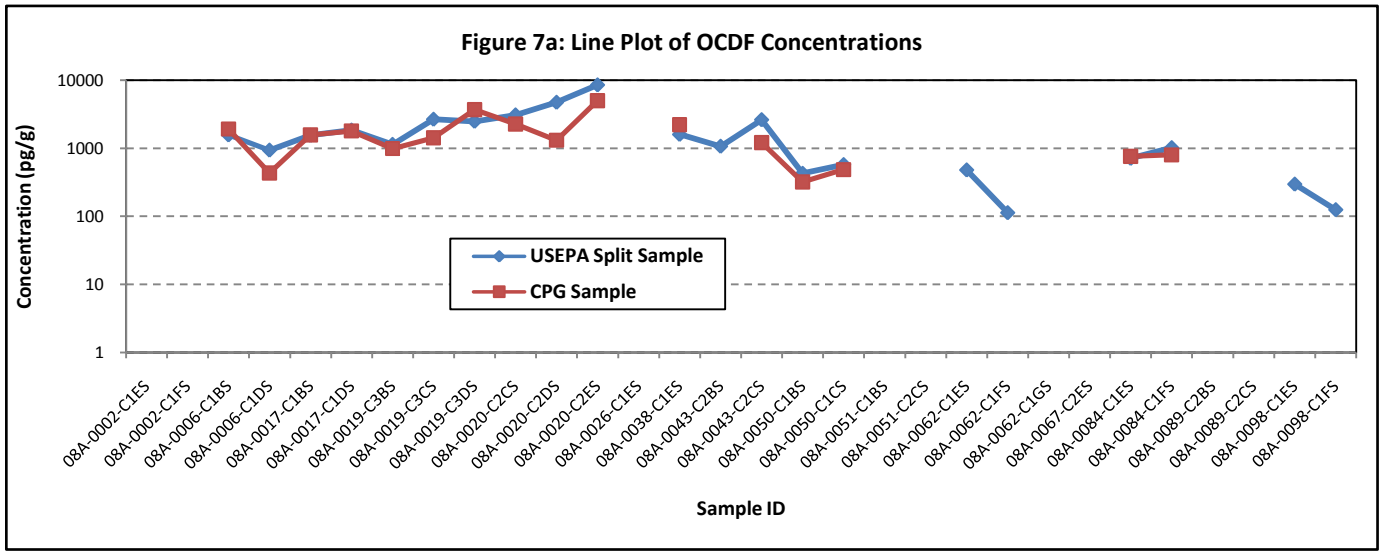


Figure 7a: Line Plot of OCDF Concentrations
Concentration (pg/g)
10000
1000
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C1BS
08A-0006-C1DS
08A-0017-C1BS
08A-0017-C1DS
08A-0019-C3BS
08A-0019-C3CS
08A-0019-C3DS
08A-0020-C2CS
08A-0020-C2DS
08A-0020-C2ES
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C2BS
08A-0043-C2CS
08A-0050-C1BS
08A-0050-C1CS
08A-0051-C1BS
08A-0051-C2CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2BS
08A-0089-C2CS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

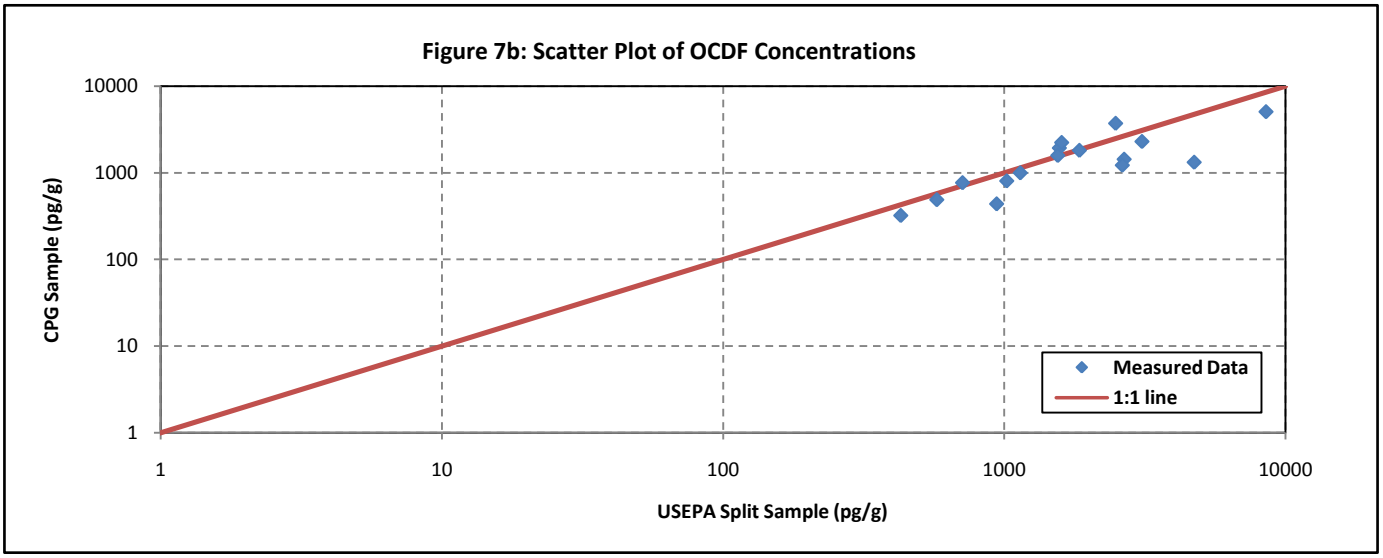


Figure 7b: Scatter Plot of OCDF Concentrations
CPG Sample (pg/g)
10000
1000
100
10
1
Measured Data
1:1 line
1
10
100
1000
10000
USEPA Split Sample (pg/g)

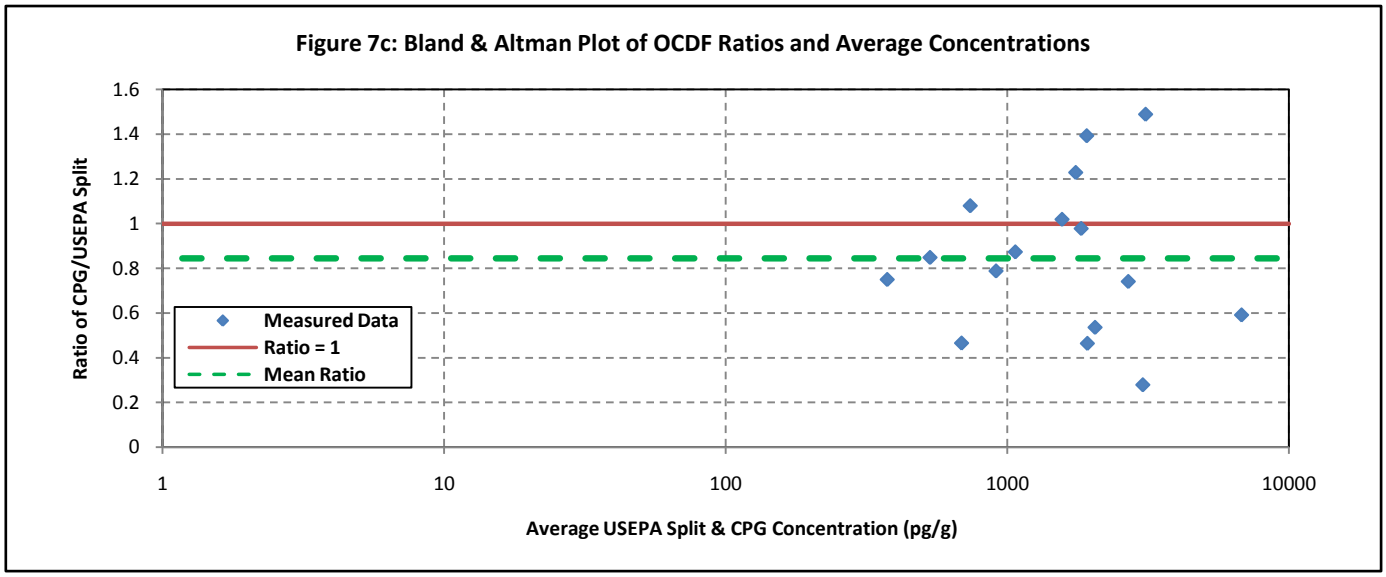
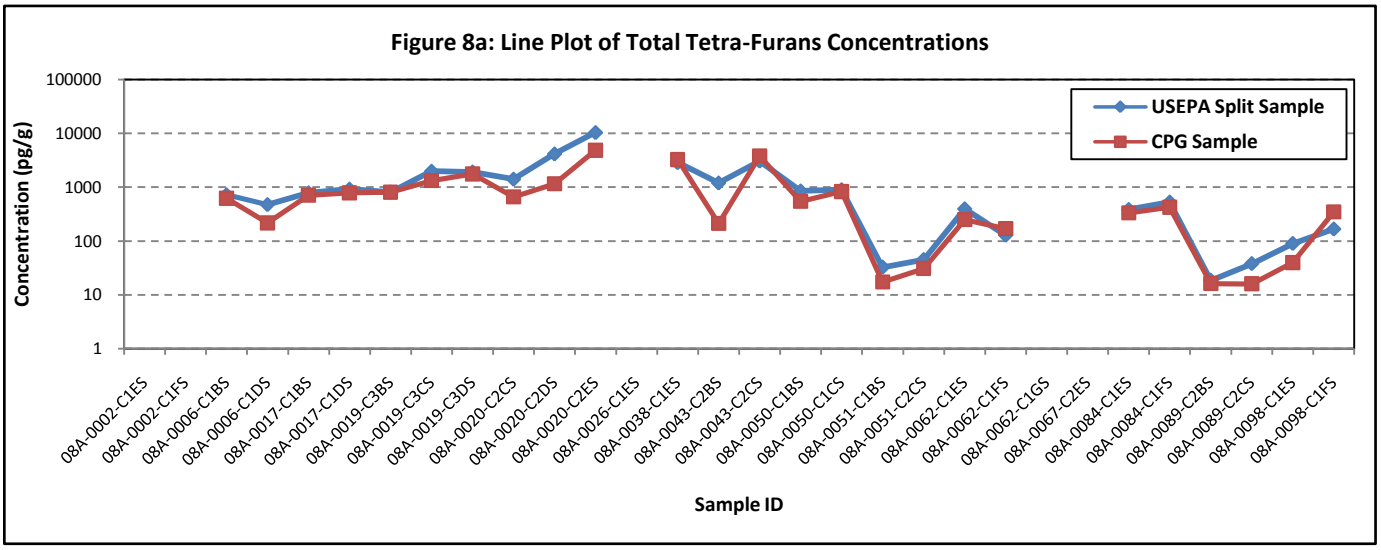
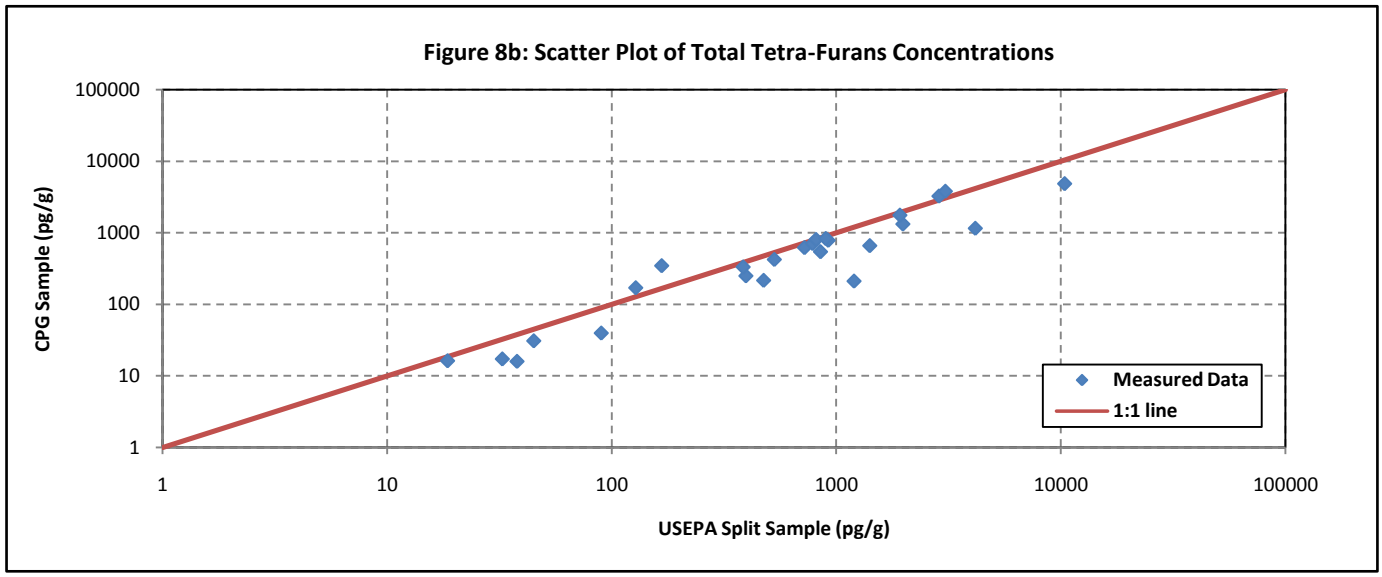
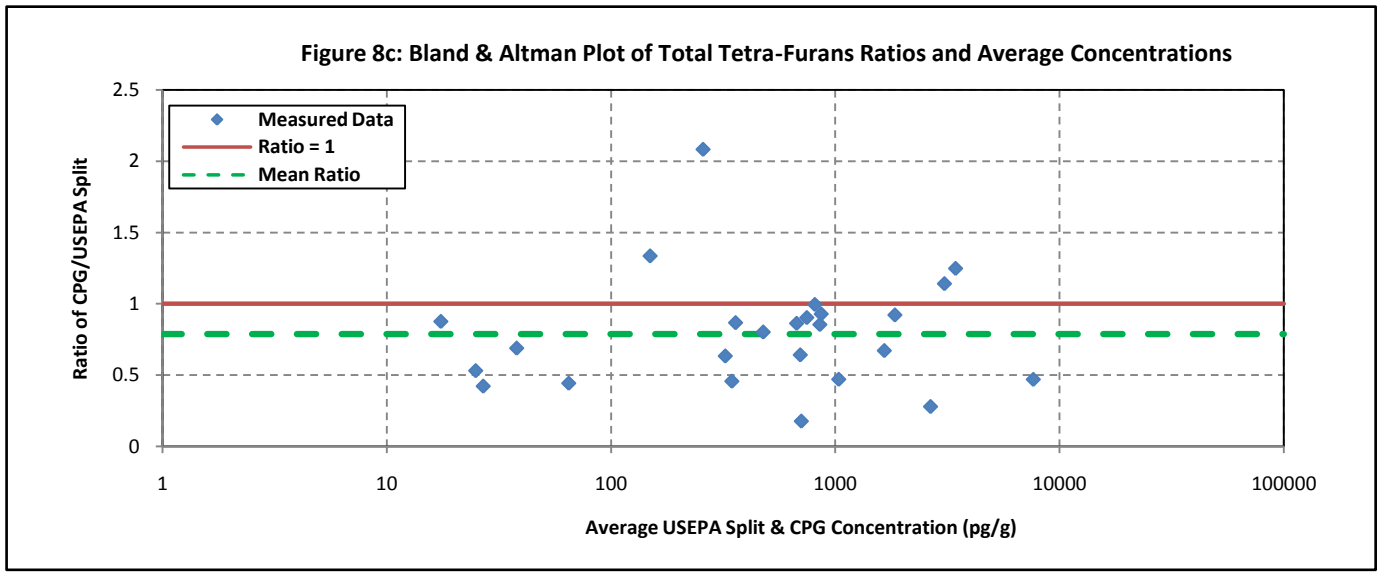


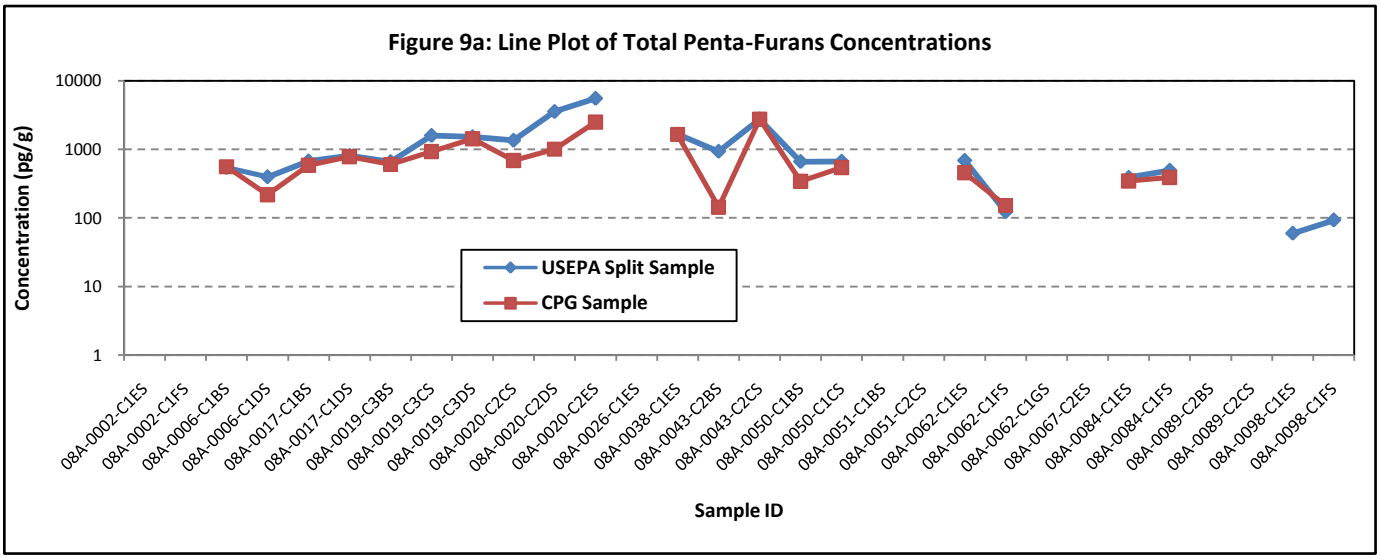
Figure 7c: Bland & Altman Plot of OCDF Ratios and Average Concentrations
Ratio of CPG/USEPA Split
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
1000
10000
Average USEPA Split & CPG Concentration (pg/g)

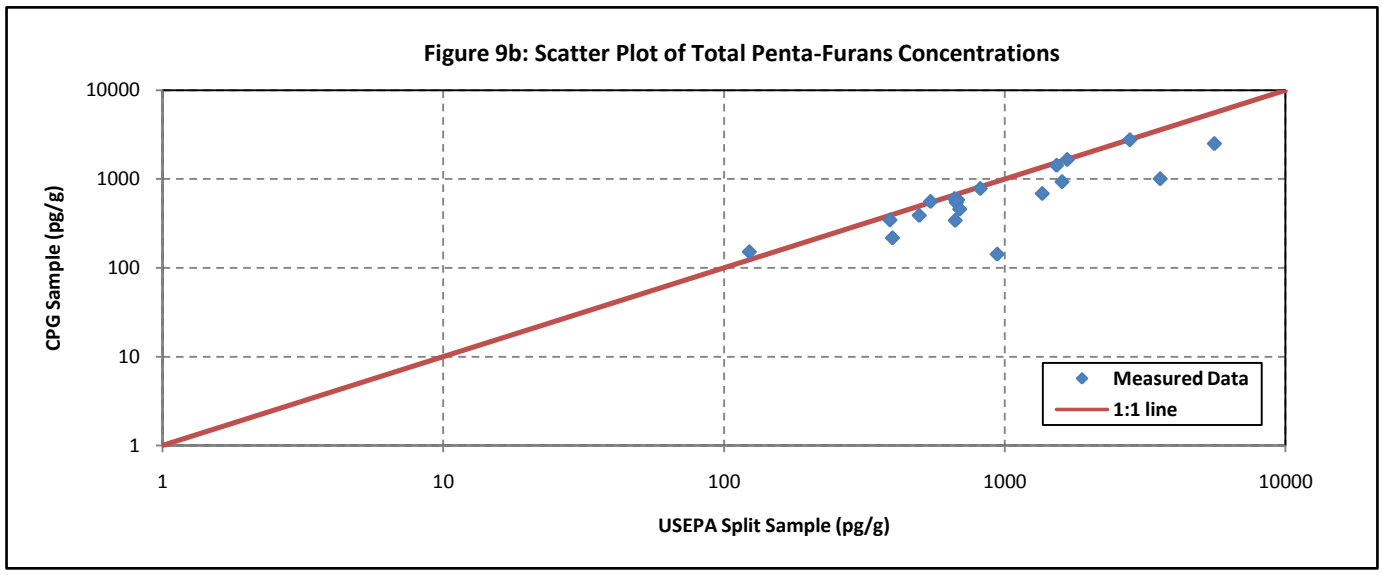


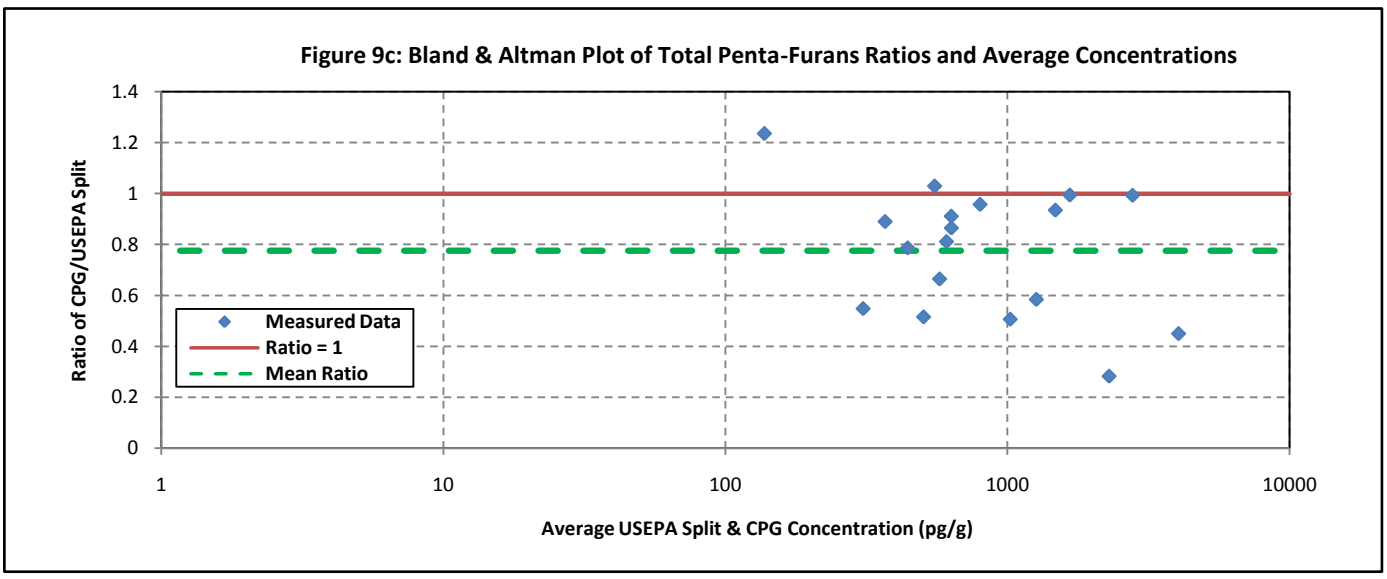




US Army Corps of Engineers®	**Statistical Plots of Total Tetra-Furan Concentrations**	**Figure 8**







US Army Corps of Engineers®	**Statistical Plots of Total Penta-Furans Concentrations**	**Figure 9**

Figure 10a: Line Plot of Total Hexa-Dioxins Concentrations

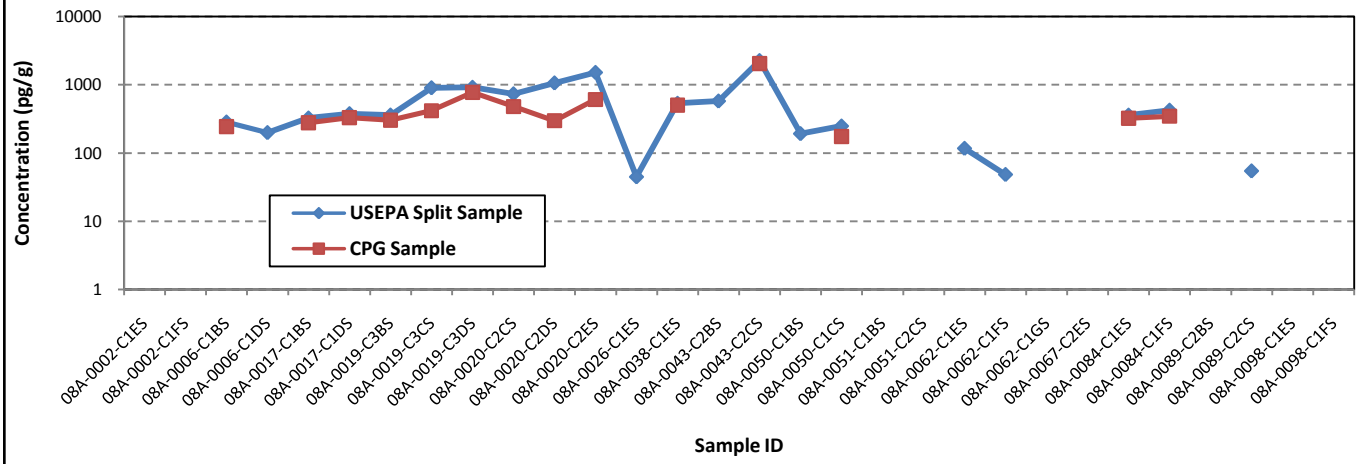


Figure 10b: Scatter Plot of Total Hexa-Dioxins Concentrations

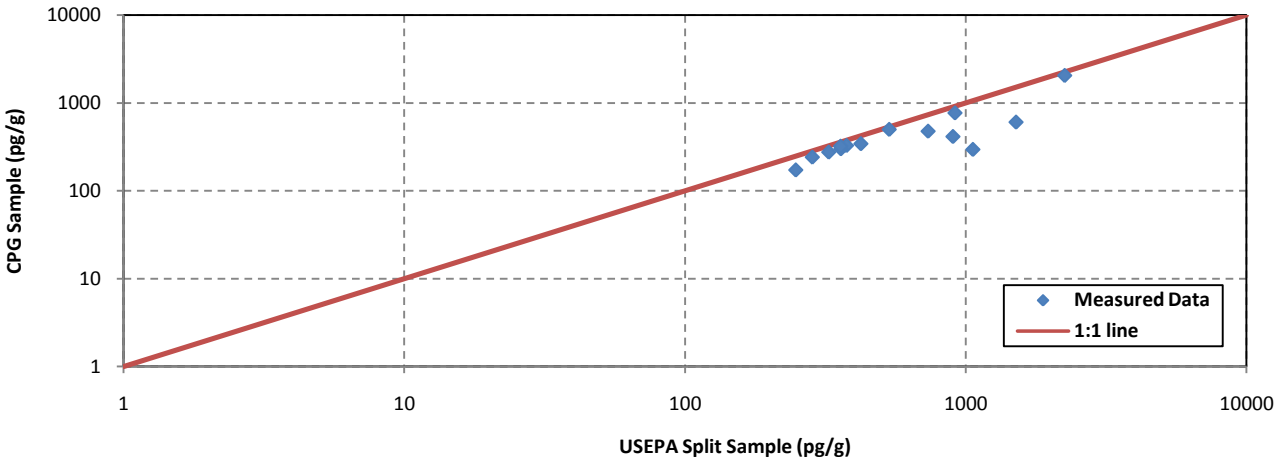
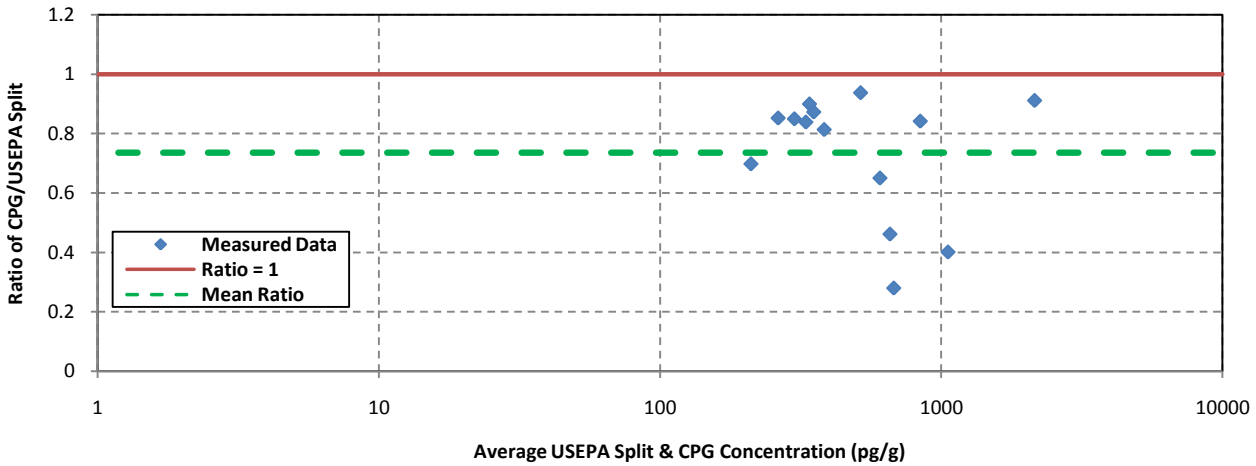


Figure 10c: Bland & Altman Plot of Total Hexa-Dioxins Ratios and Average Concentrations



US Army Corps of Engineers

Statistical Plots of Total Hexa-Dioxins Concentrations

Figure 10

Figure 11a: Line Plot of Total Hexa-Furans Concentrations

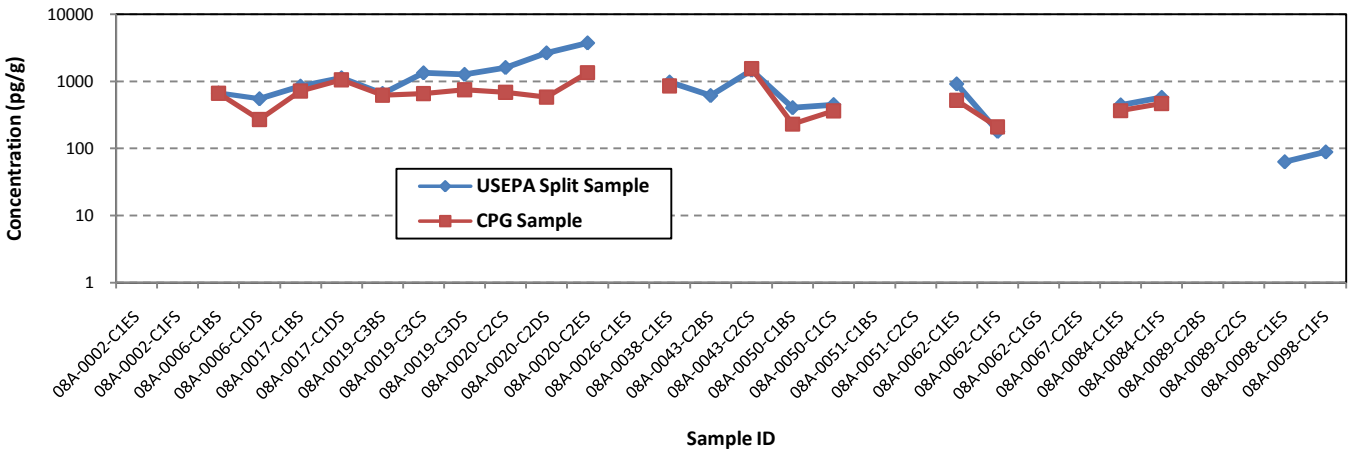


Figure 11b: Scatter Plot of Total Hexa-Furans Concentrations

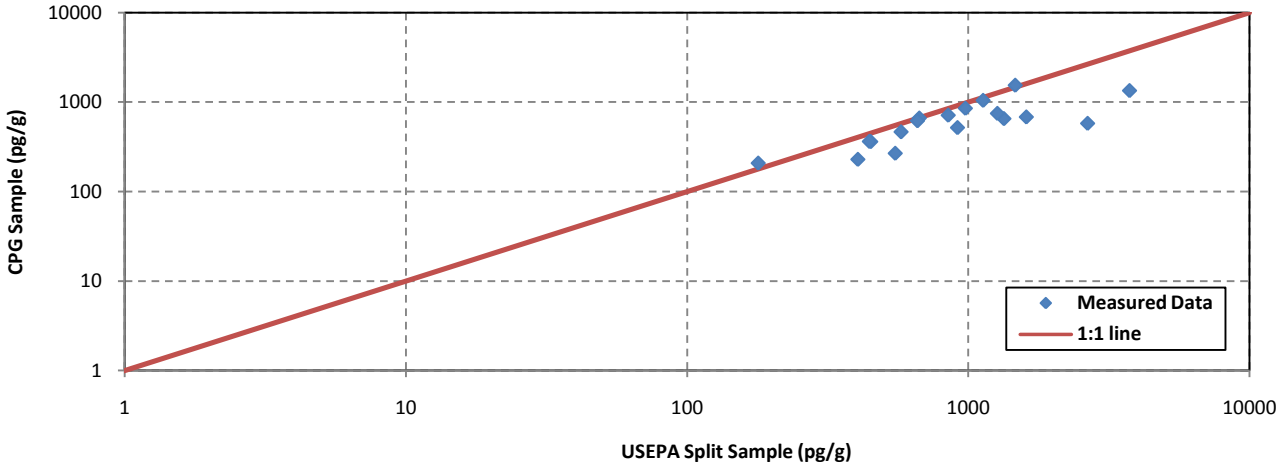
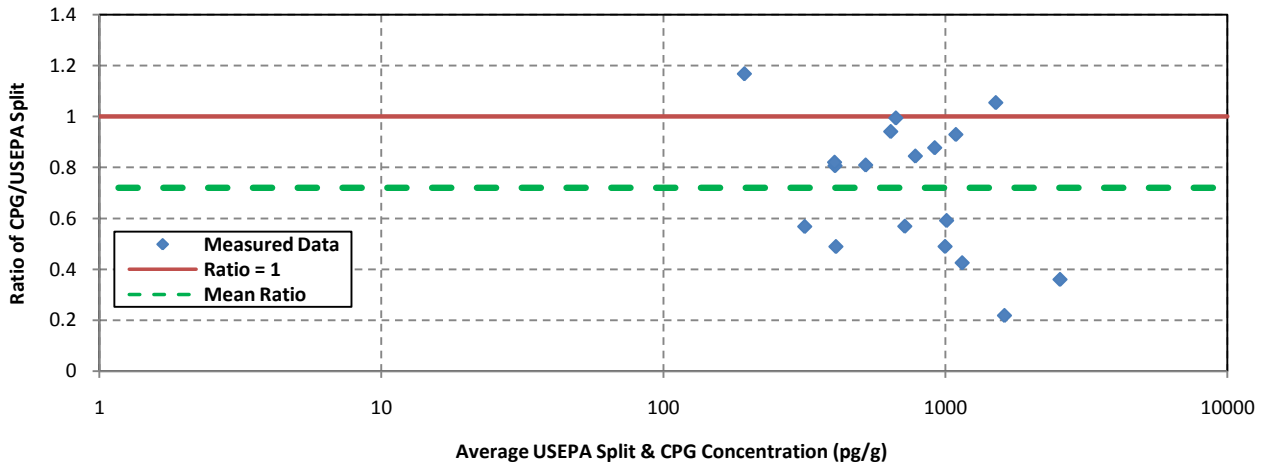


Figure 11c: Bland & Altman Plot of Total Hexa-Furans Ratios and Average Concentrations



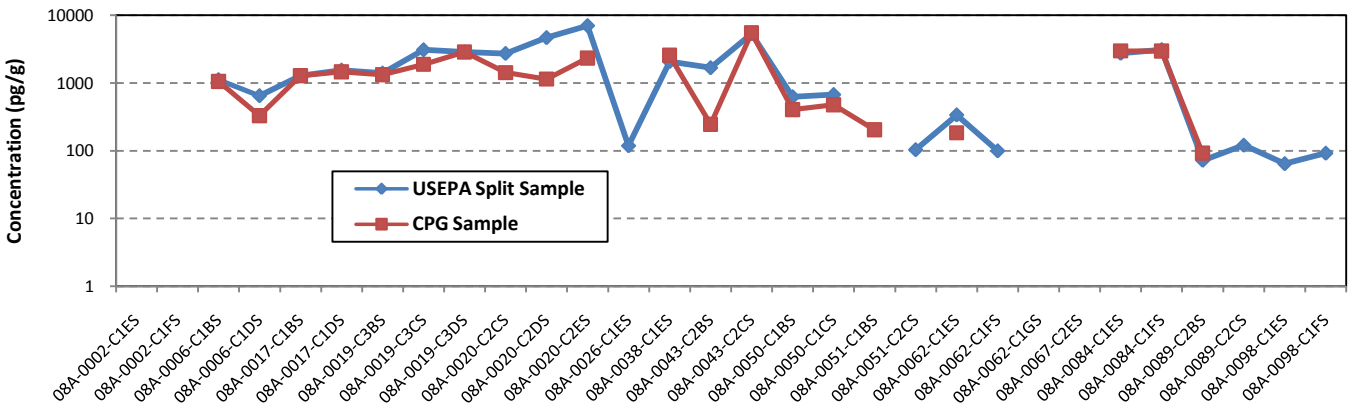


Figure 12a: Line Plot of Total Hepta-Dioxins Concentrations
Concentration (pg/g)
10000
1000
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C1BS
08A-0006-C1DS
08A-0017-C1BS
08A-0017-C1DS
08A-0019-C3BS
08A-0019-C3CS
08A-0019-C3DS
08A-0020-C2CS
08A-0020-C2DS
08A-0020-C2ES
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C2BS
08A-0043-C2CS
08A-0050-C1BS
08A-0050-C1CS
08A-0051-C1BS
08A-0051-C2CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2BS
08A-0089-C2CS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

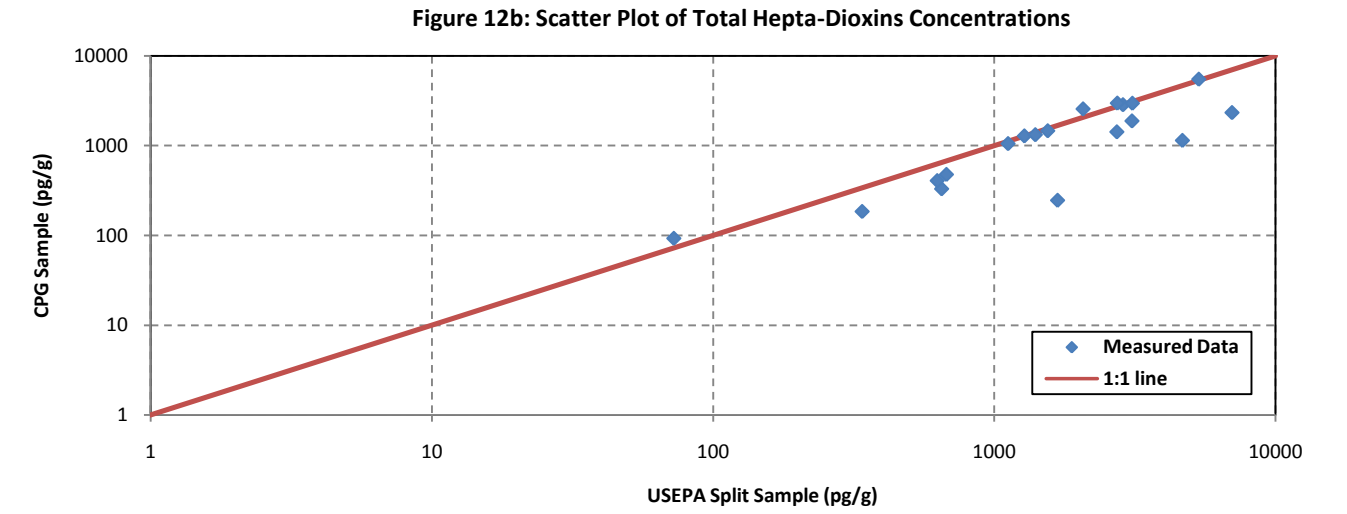


Figure 12b: Scatter Plot of Total Hepta-Dioxins Concentrations
CPG Sample (pg/g)
10000
1000
100
10
1
Measured Data
1:1 line
1
10
100
1000
10000
USEPA Split Sample (pg/g)

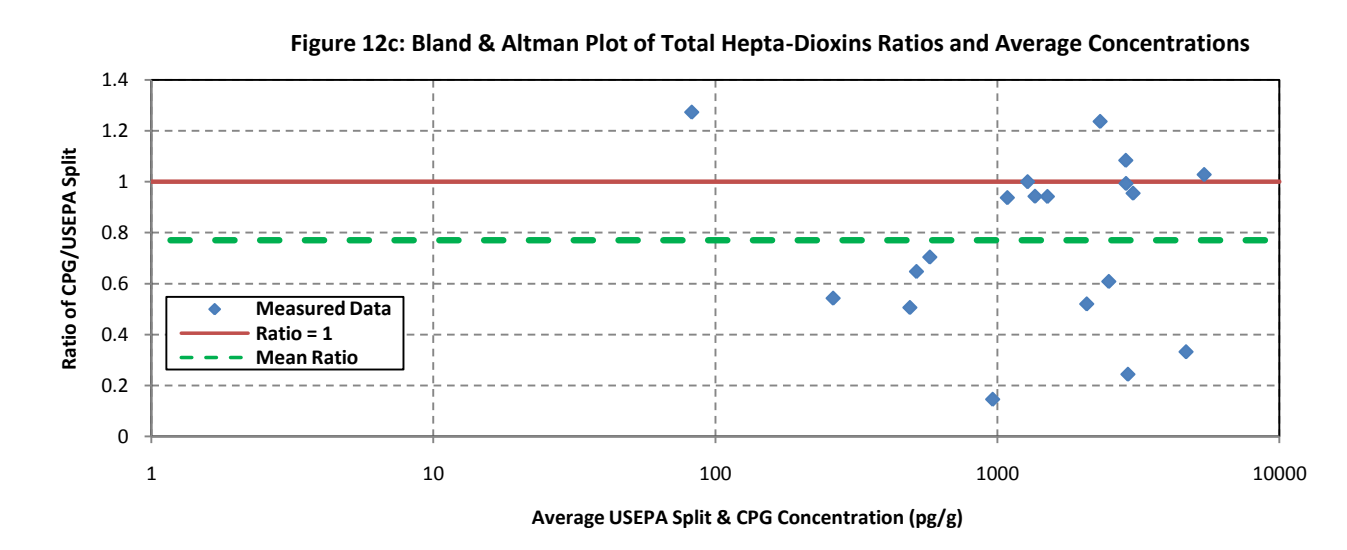
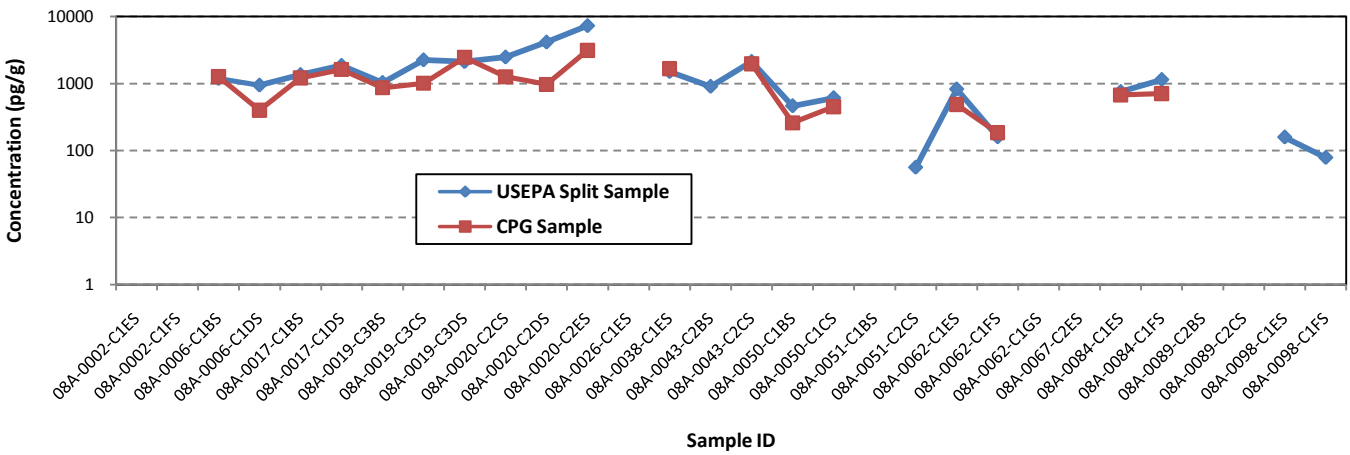
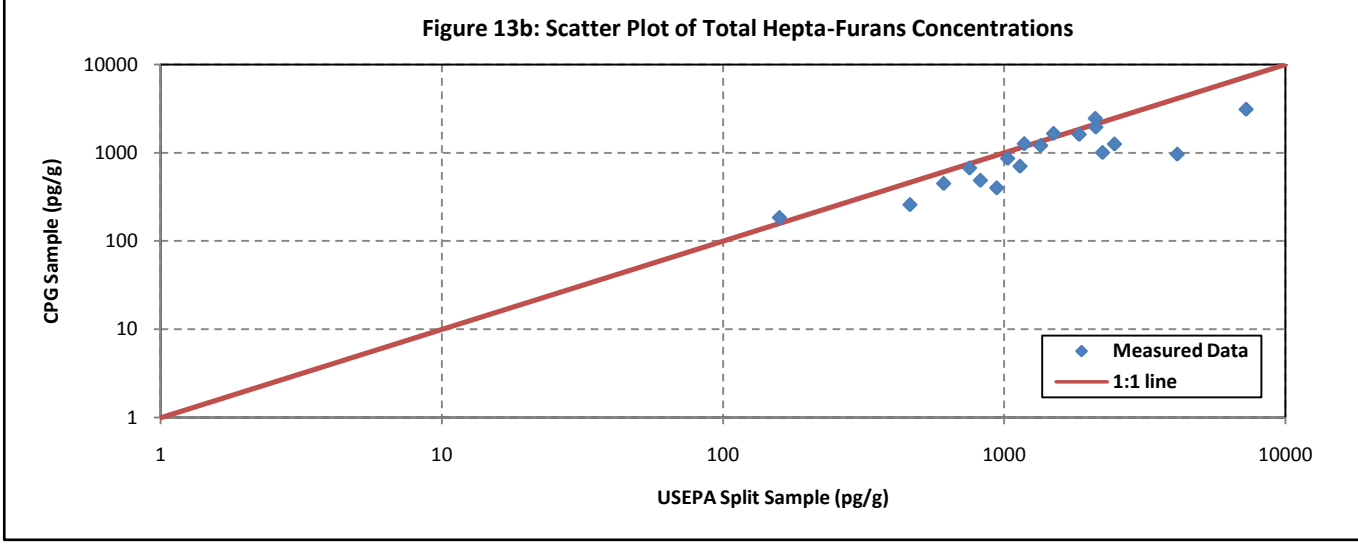
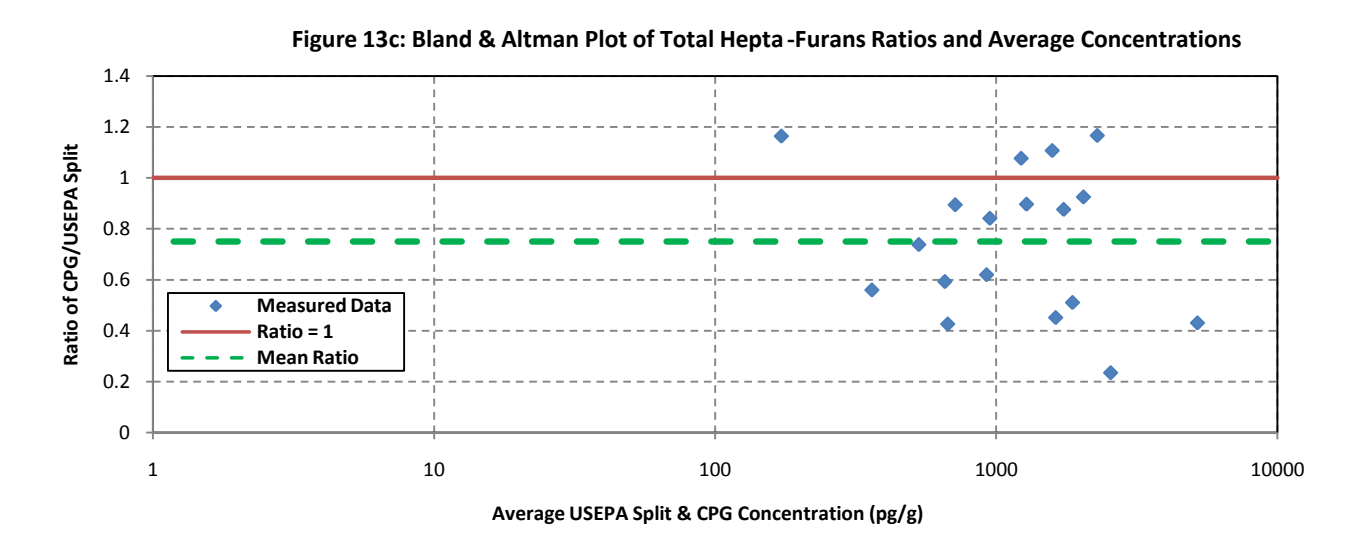


Figure 12c: Bland & Altman Plot of Total Hepta-Dioxins Ratios and Average Concentrations
Ratio of CPG/USEPA Split
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
1000
10000
Average USEPA Split & CPG Concentration (pg/g)







US Army Corps of Engineers®

Statistical Plots of Total Hepta-Furans Concentrations

Figure 13

Figure 14a: Line Plot of 2,2',5-Trichlorobiphenyl (BZ 18) Concentrations

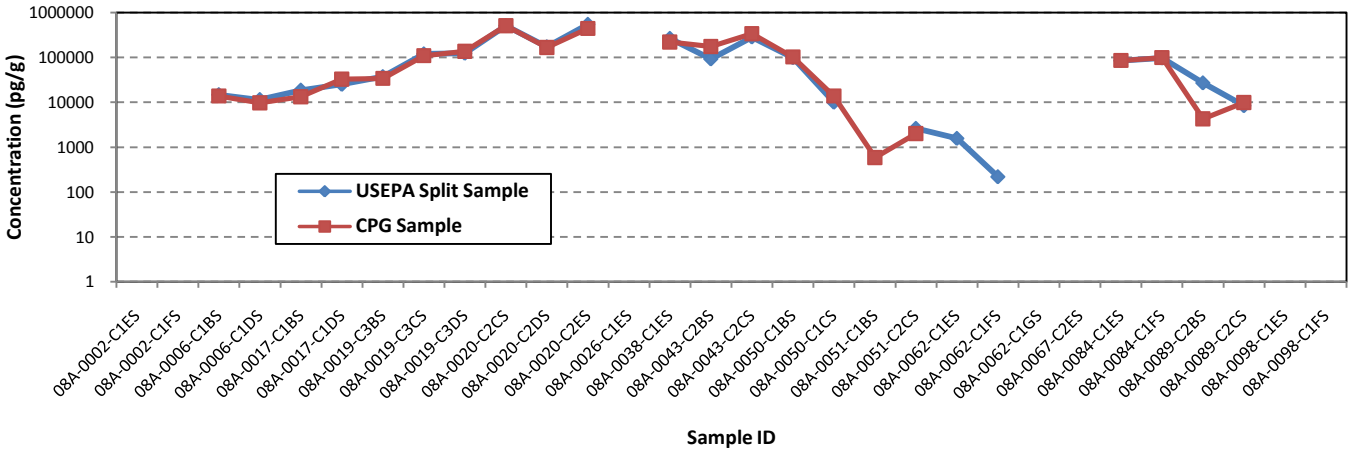


Figure 14b: Scatter Plot of 2,2',5-Trichlorobiphenyl (BZ 18) Concentrations

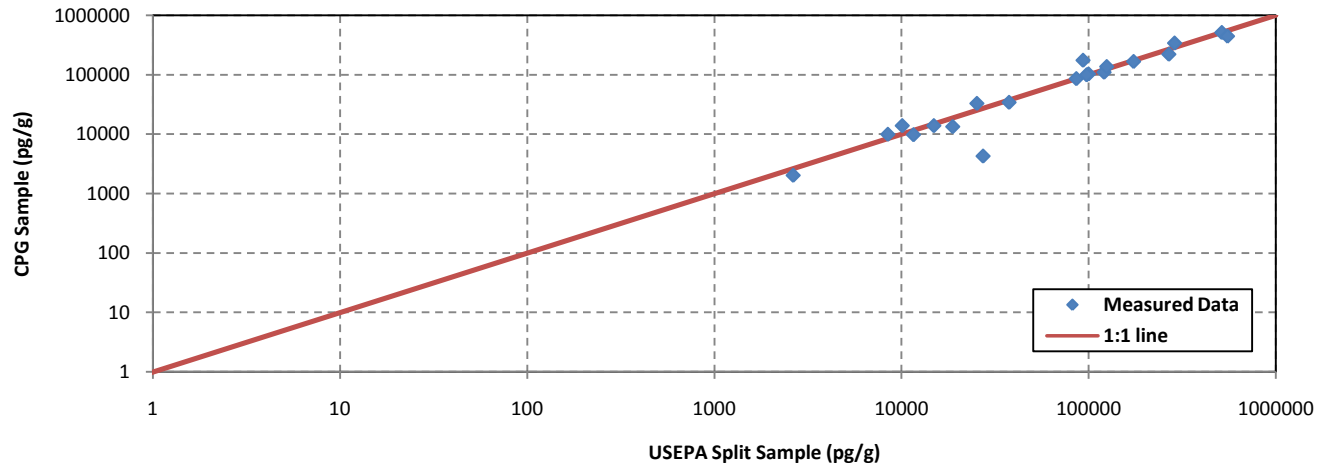


Figure 14c: Bland & Altman Plot of 2,2',5-Trichlorobiphenyl (BZ 18) Ratios and Average Concentrations

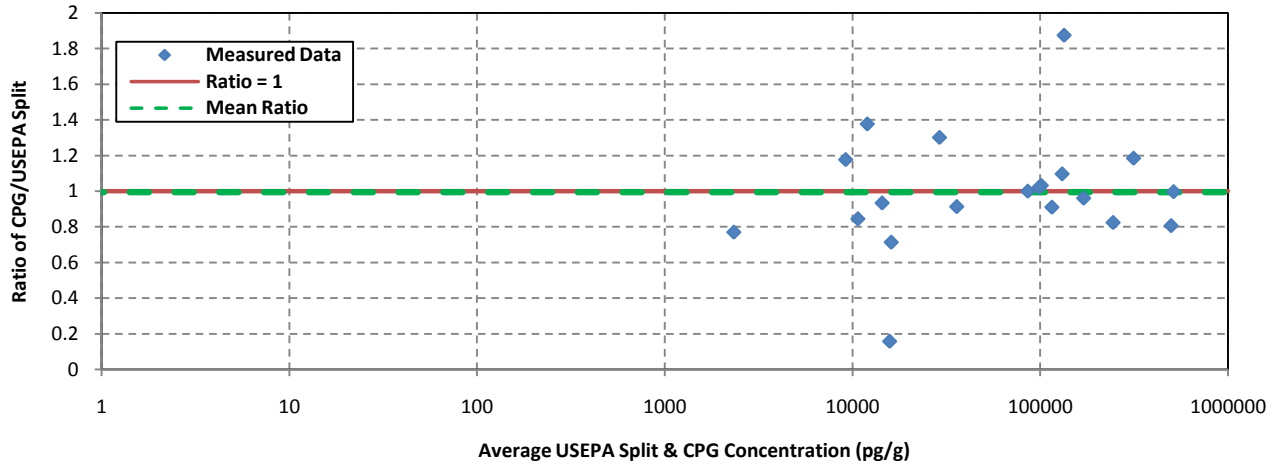


Figure 15a: Line Plot of 2,4',5-Trichlorobiphenyl (BZ 31) Concentrations

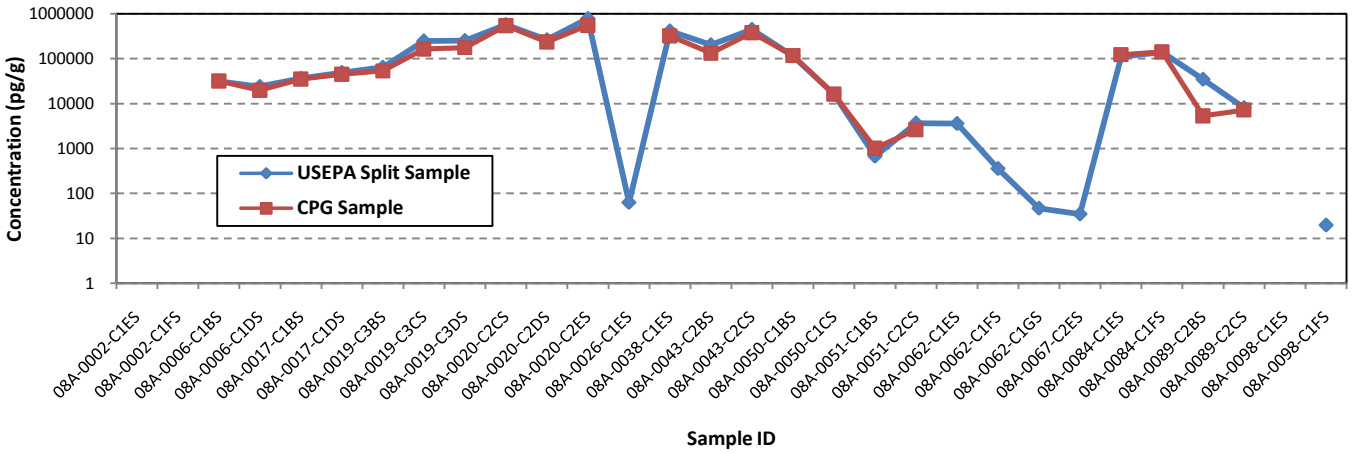


Figure 15b: Scatter Plot of 2,4',5-Trichlorobiphenyl (BZ 31) Concentrations

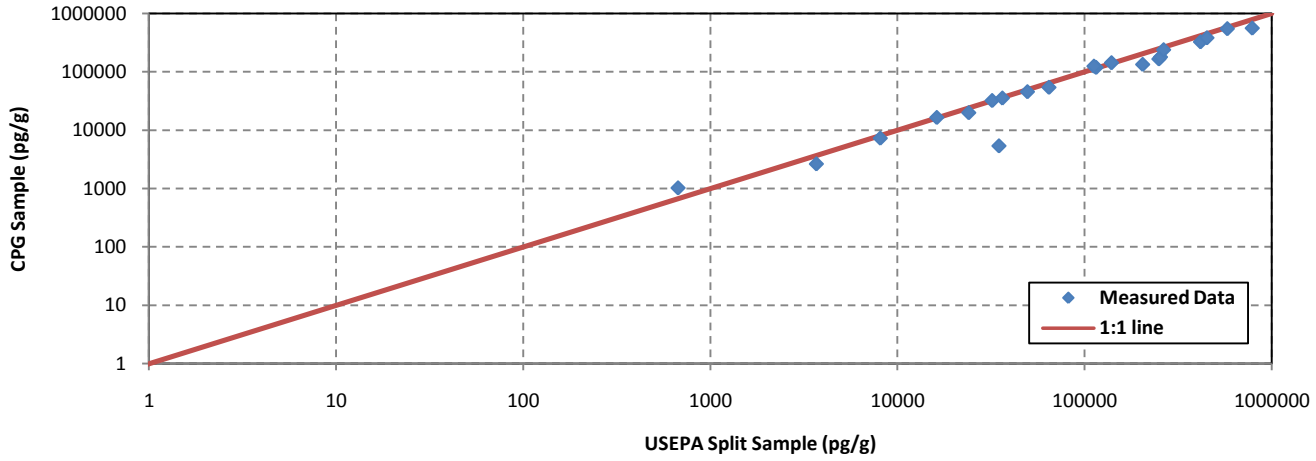


Figure 15c: Bland & Altman Plot of 2,4',5-Trichlorobiphenyl (BZ 31) Ratios and Average Concentrations

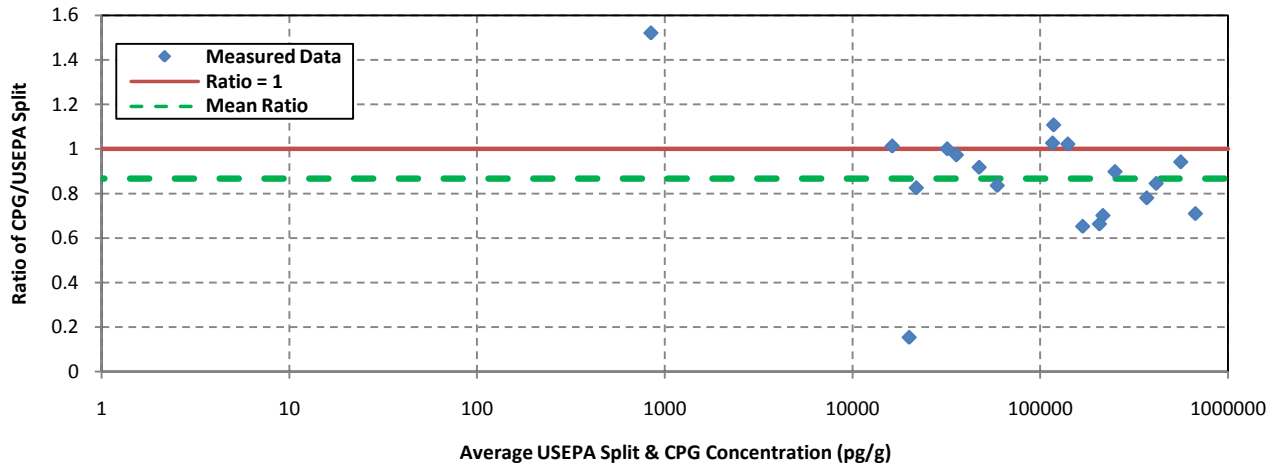


Figure 16a: Line Plot of 2,2',5,5'-Tetrachlorobiphenyl (BZ 52) Concentrations

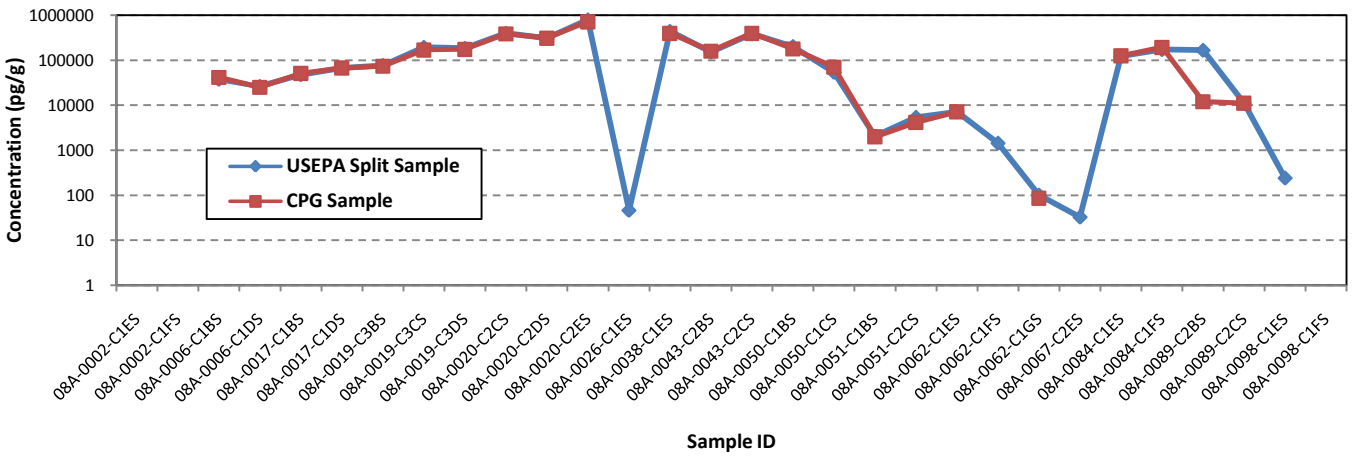


Figure 16b: Scatter Plot of 2,2',5,5'-Tetrachlorobiphenyl (BZ 52) Concentrations

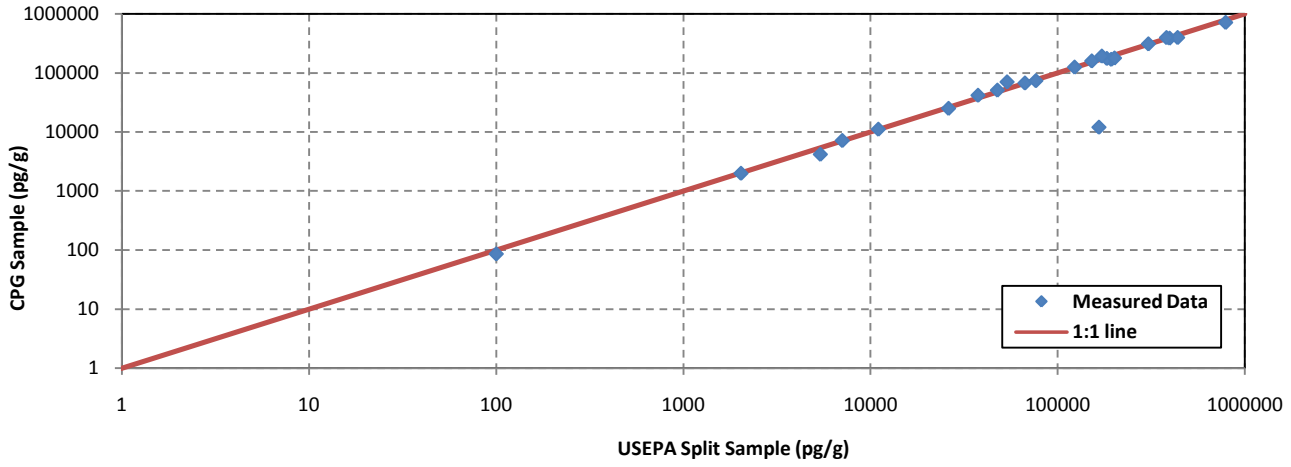


Figure 16c: Bland & Altman Plot of 2,2',5,5'-Tetrachlorobiphenyl (BZ 52) Ratios and Average Concentrations

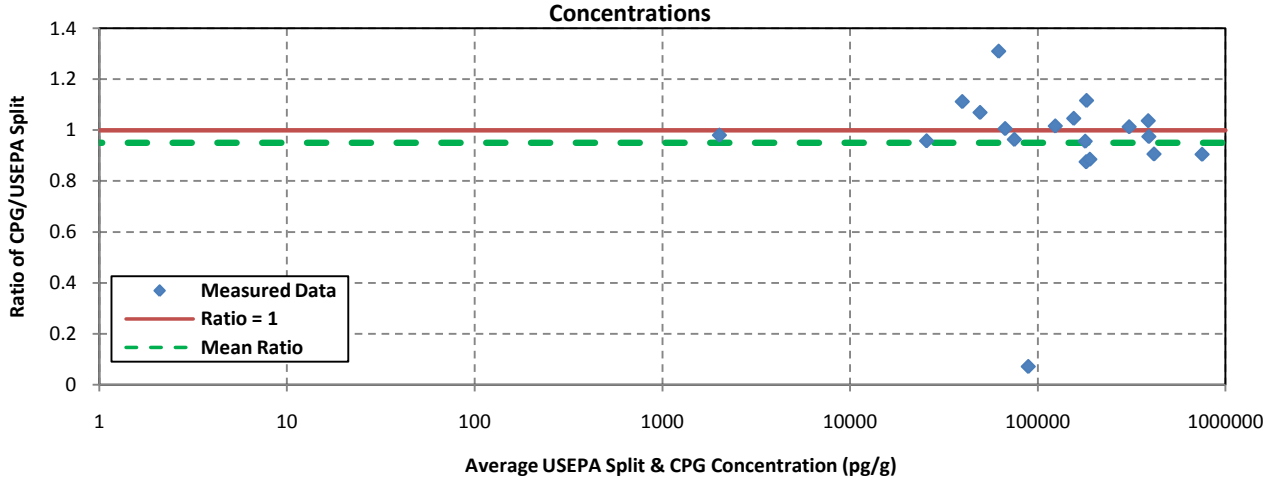


Figure 17a: Line Plot of 3,3',4,4'-Tetrachlorobiphenyl (BZ 77) Concentrations

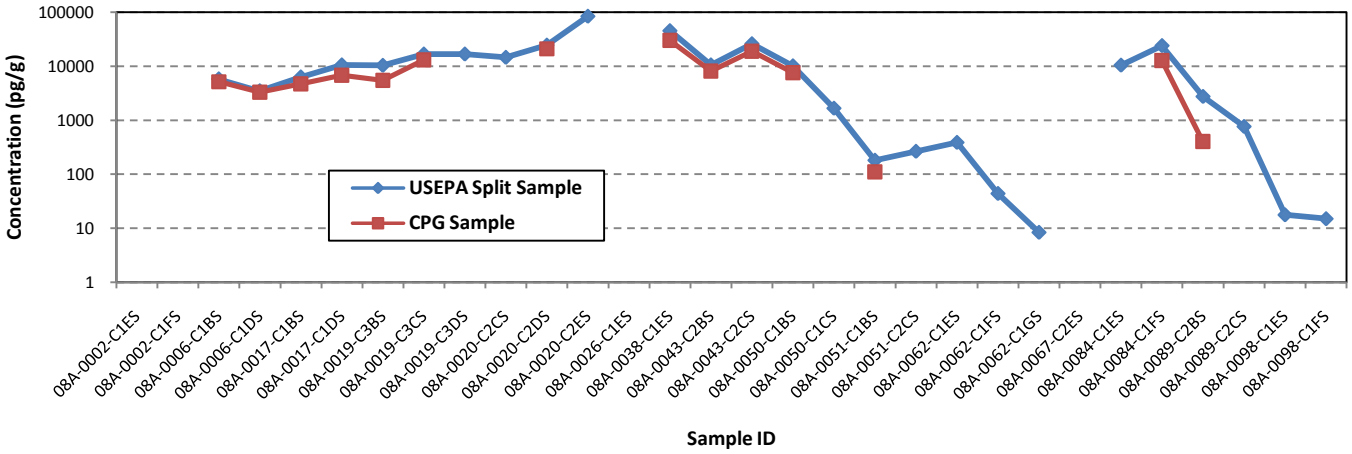


Figure 17b: Scatter Plot of 3,3',4,4'-Tetrachlorobiphenyl (BZ 77) Concentrations

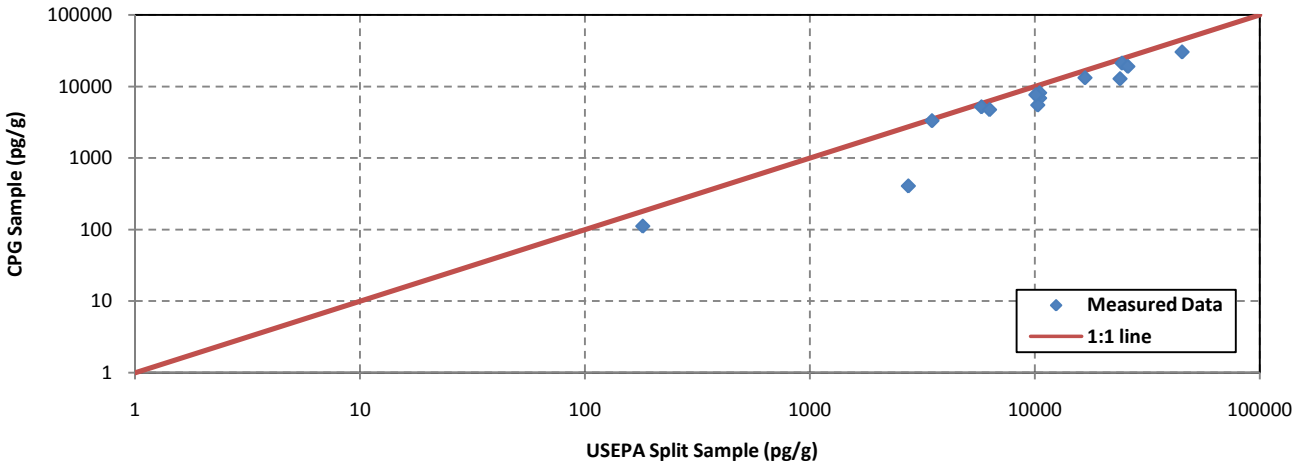


Figure 17c: Bland & Altman Plot of 3,3',4,4'-Tetrachlorobiphenyl (BZ 77) Ratios and Average Concentrations

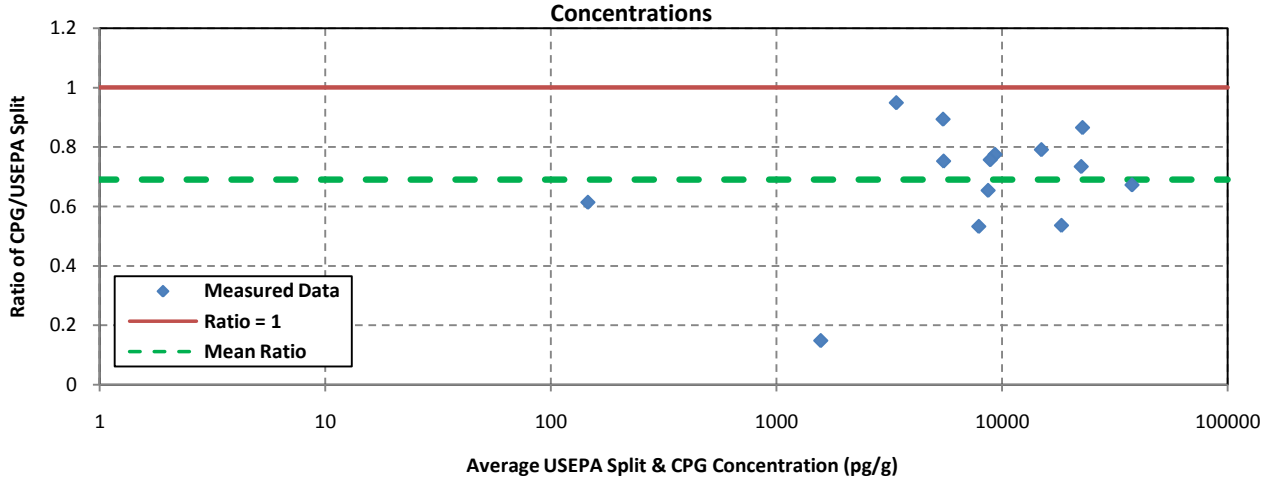


Figure 18a: Line Plot of 2,3,3',4,4'-Pentachlorobiphenyl (BZ 105) Concentrations

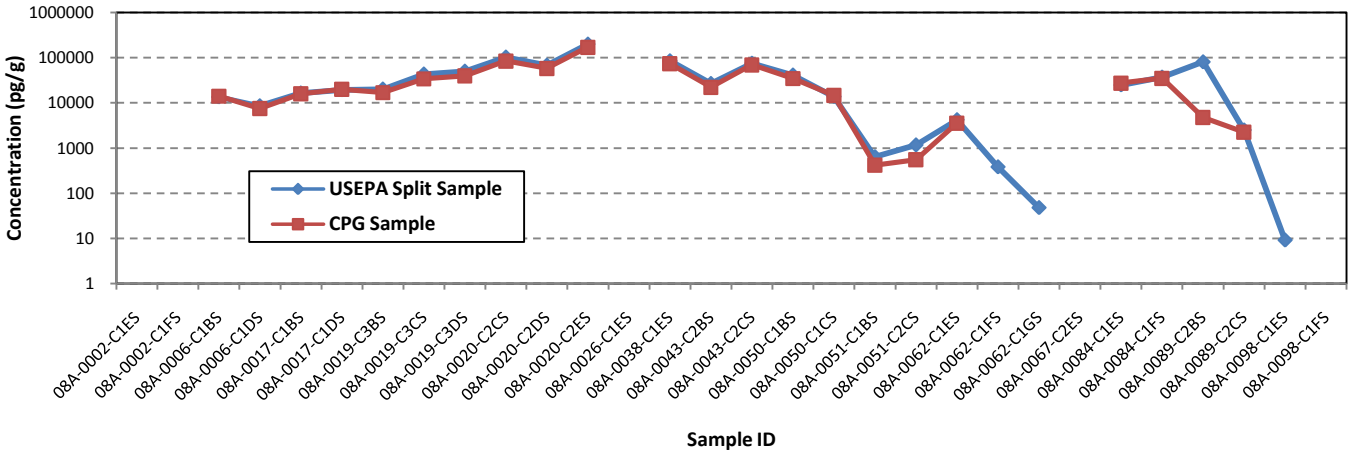


Figure 18b: Scatter Plot of 2,3,3',4,4'-Pentachlorobiphenyl (BZ 105) Concentrations

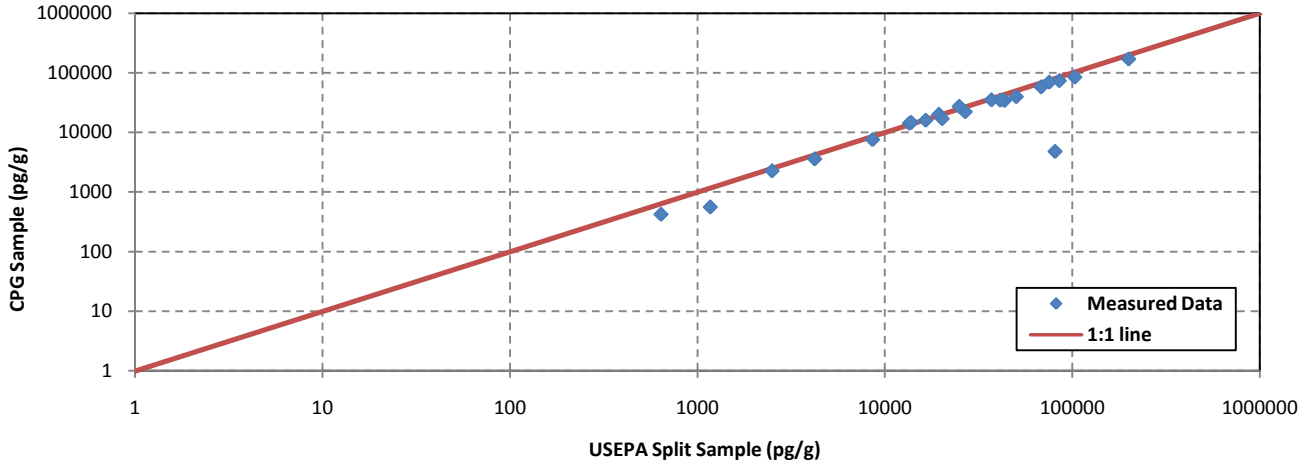


Figure 18c: Bland & Altman Plot of 2,3,3',4,4'-Pentachlorobiphenyl (BZ 105) Ratios and Average Concentrations

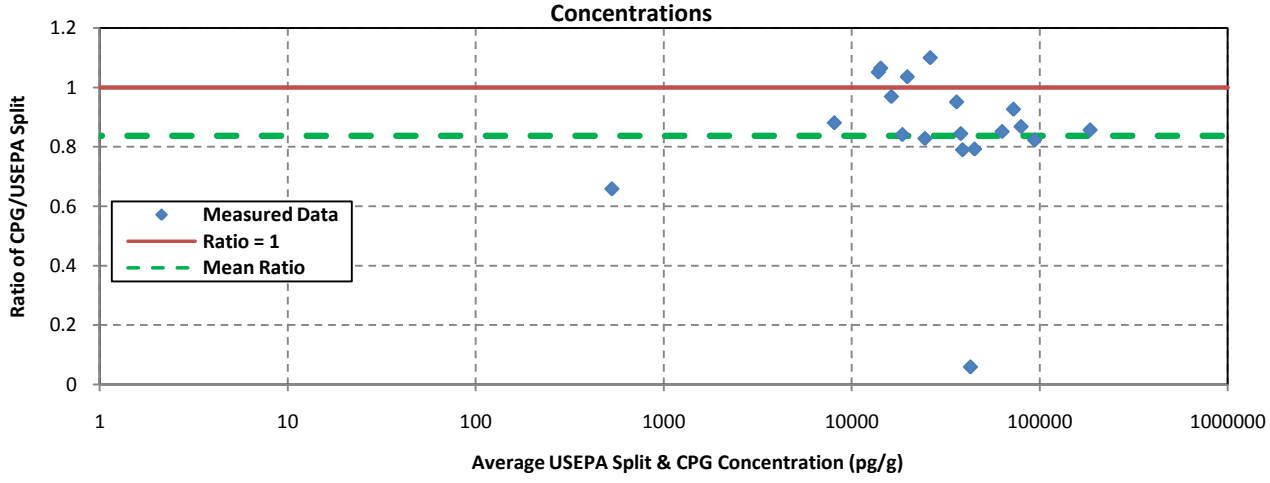


Figure 19a: Line Plot of 2,3,3',4',6-Pentachlorobiphenyl (BZ 110) Concentrations

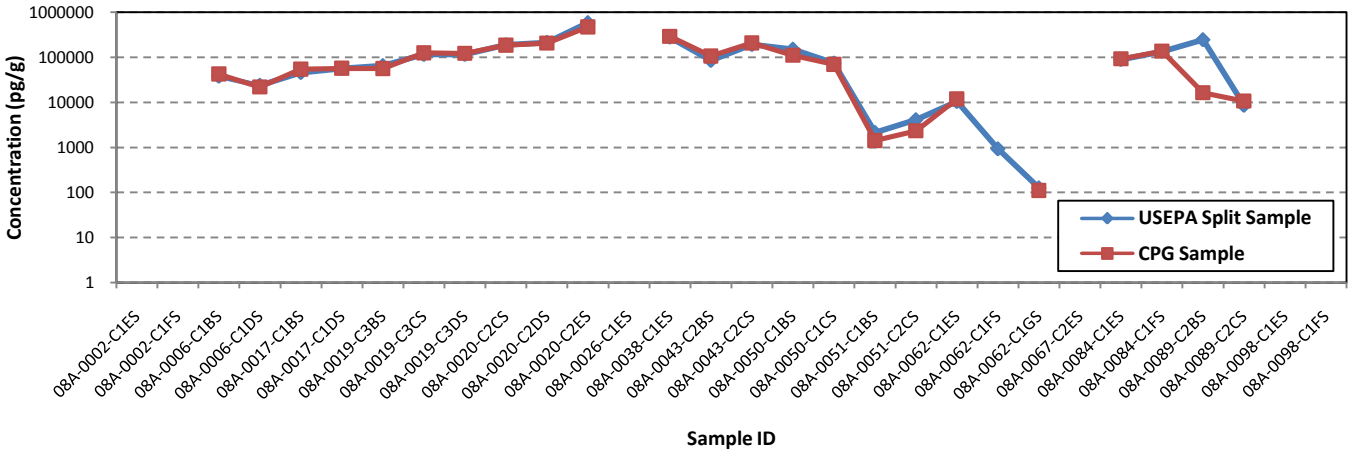


Figure 19b: Scatter Plot of 2,3,3',4',6-Pentachlorobiphenyl (BZ 110) Concentrations

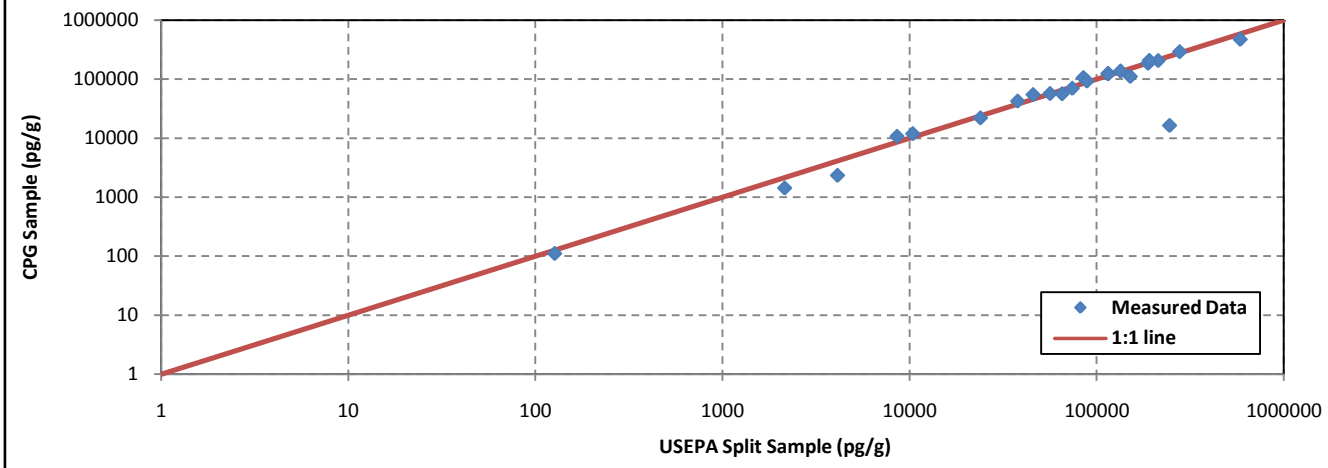


Figure 19c: Bland & Altman Plot of 2,3,3',4',6-Pentachlorobiphenyl (BZ 110) Ratios and Average Concentrations

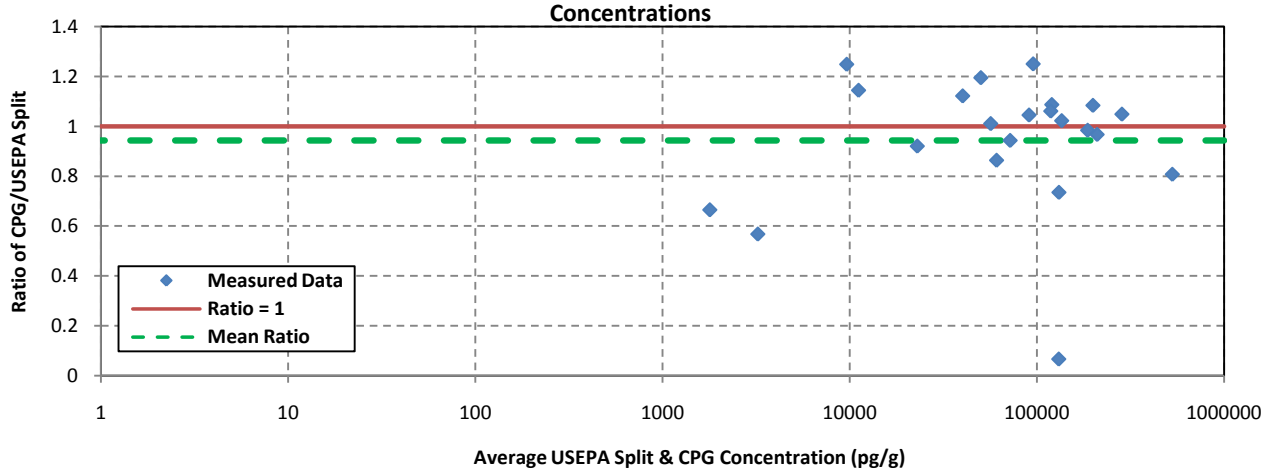


Figure 20a: Line Plot of 2,3',4,4',5-Pentachlorobiphenyl (BZ 118) Concentrations

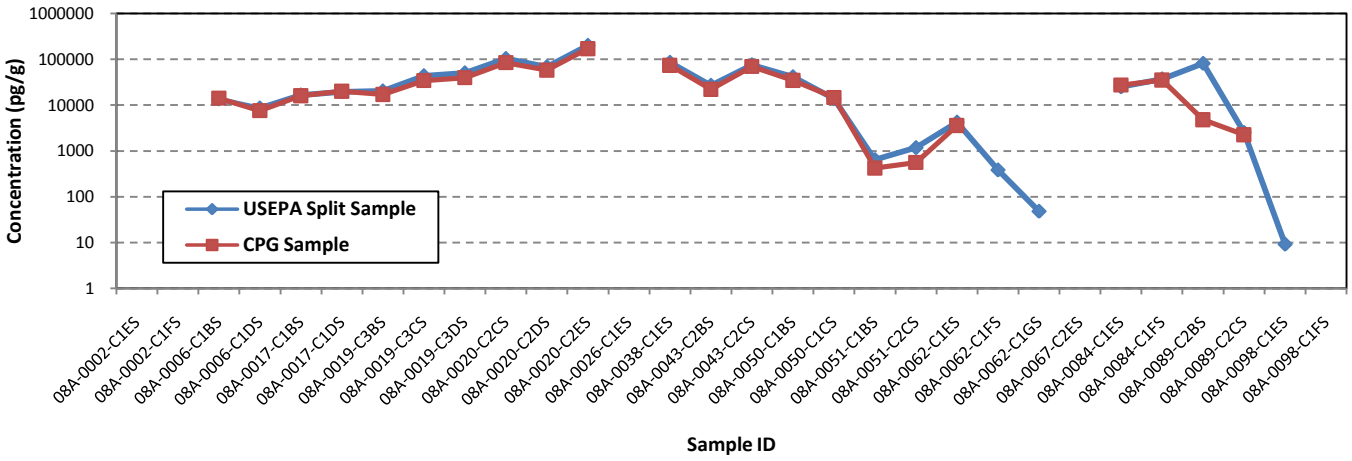


Figure 20b: Scatter Plot of 2,3',4,4',5-Pentachlorobiphenyl (BZ 118) Concentrations

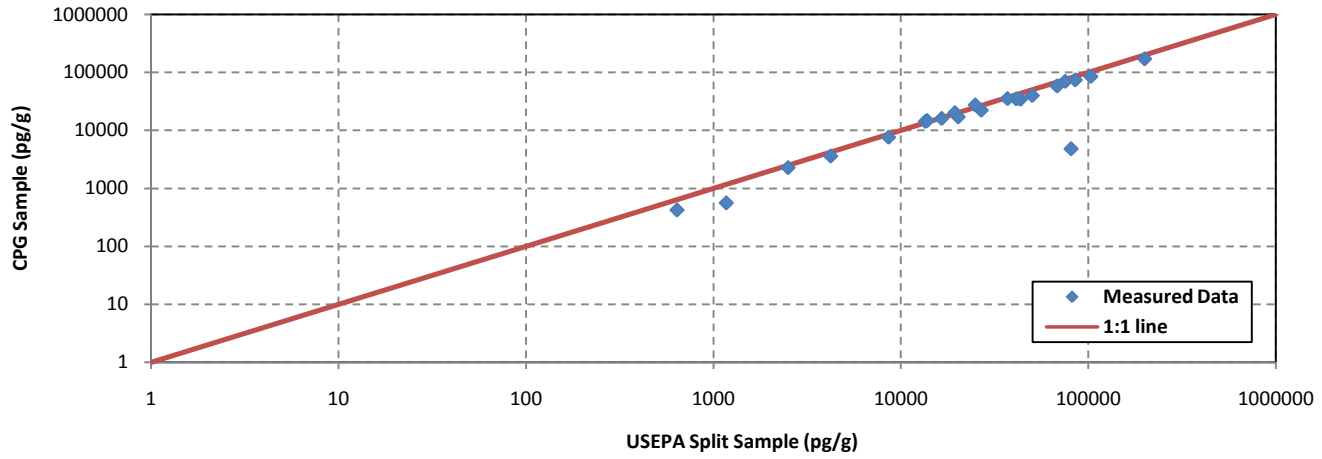


Figure 20c: Bland & Altman Plot of 2,3',4,4',5-Pentachlorobiphenyl (BZ 118) Ratios and Average Concentrations

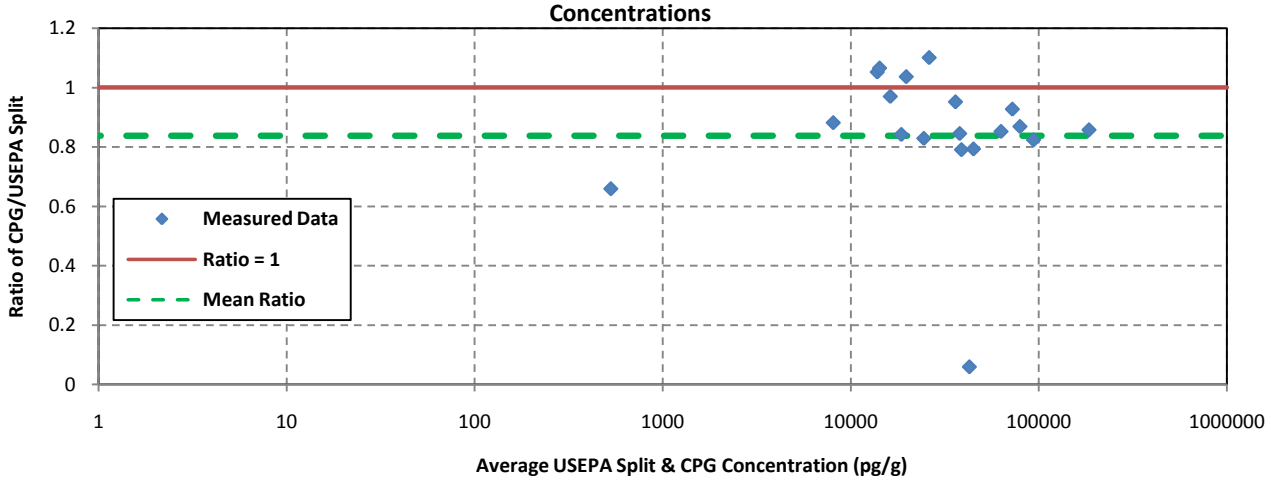


Figure 21a: Line Plot of 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153) Concentrations

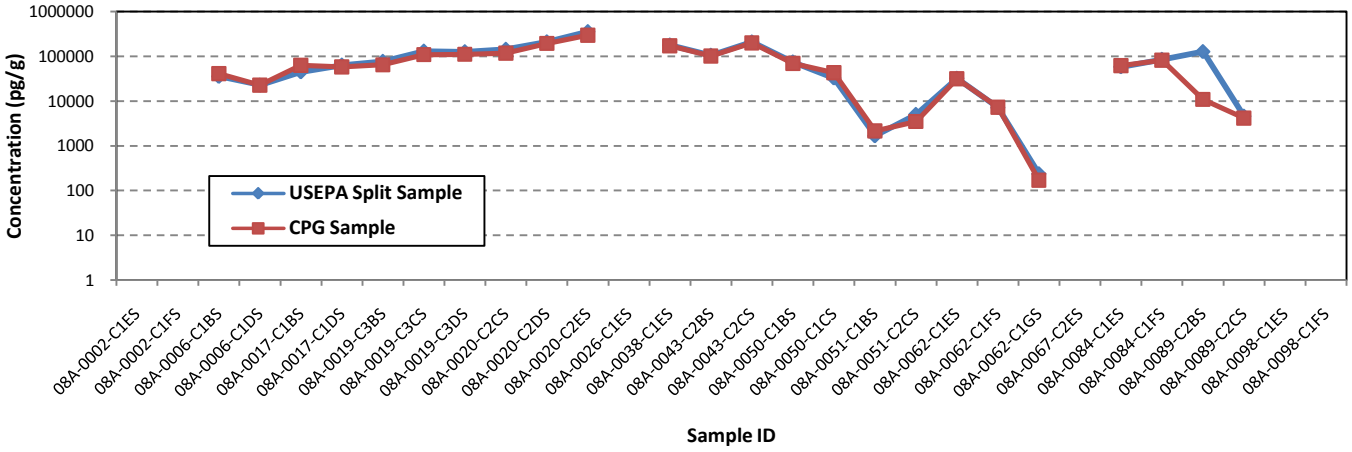


Figure 21b: Scatter Plot of 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153) Concentrations

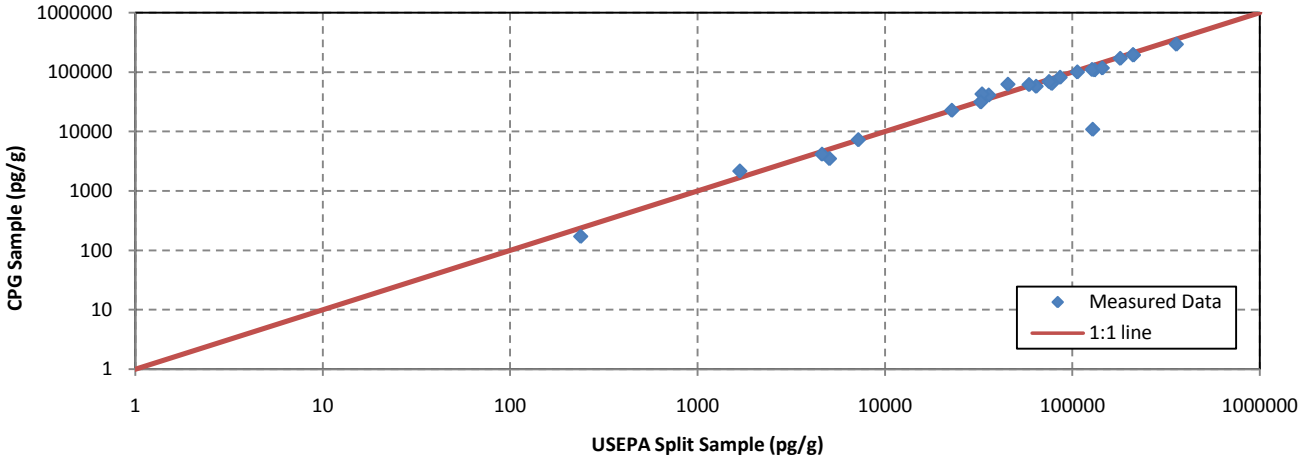
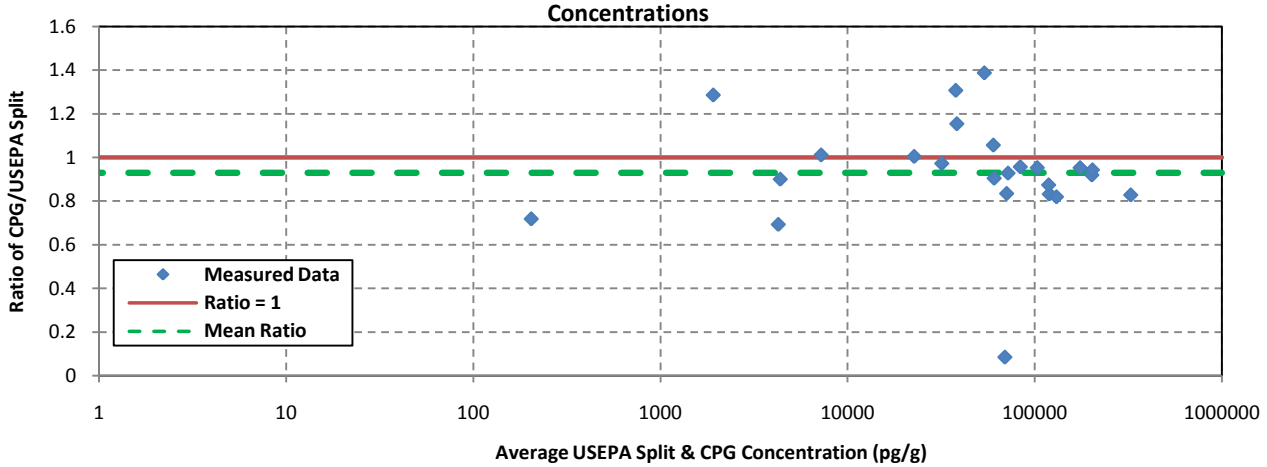
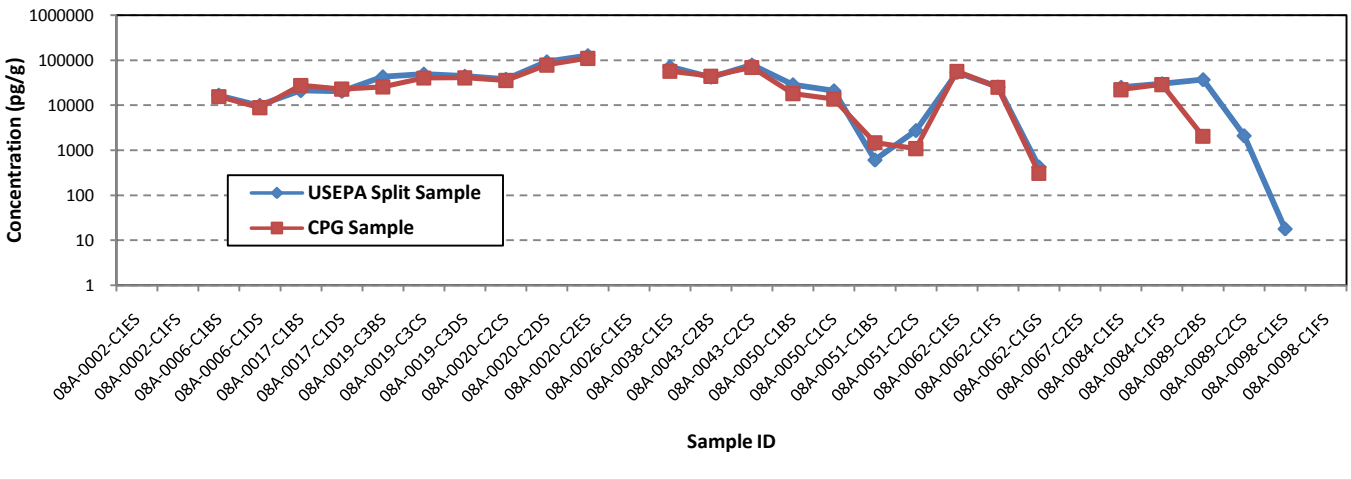
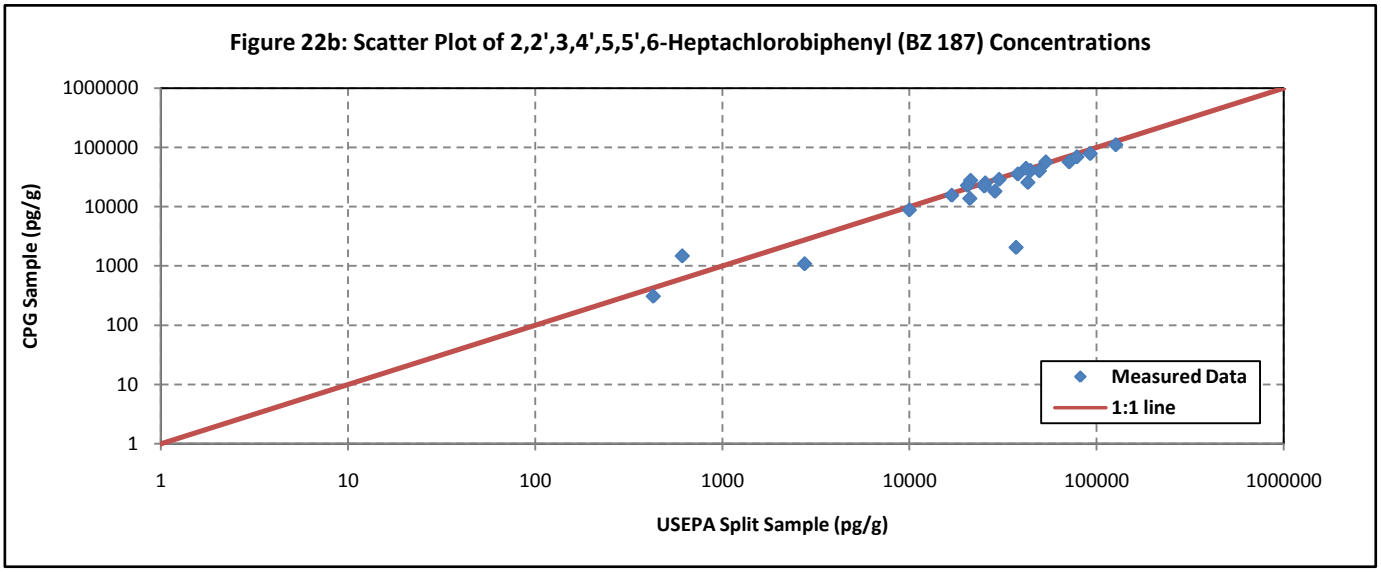


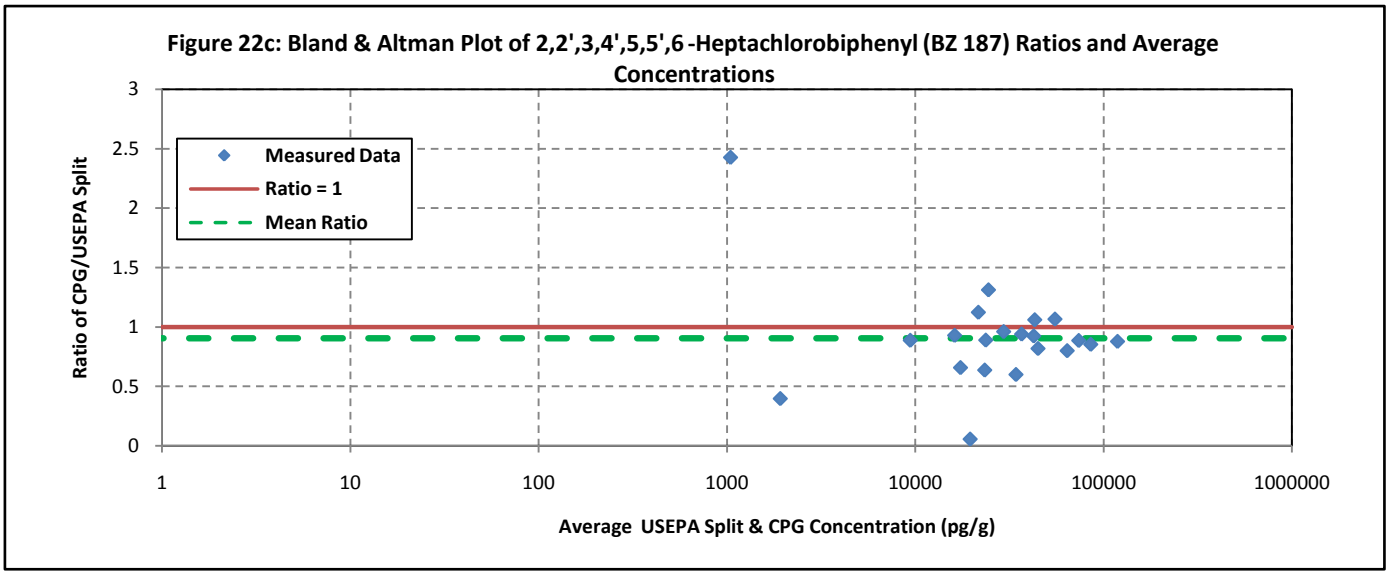
Figure 21c: Bland & Altman Plot of 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153) Ratios and Average Concentrations



US Army Corps of Engineers	**Statistical Plots of 2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153) Concentrations**	**Figure 21**







US Army Corps of Engineers®	**Statistical Plots of 2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187) Concentrations**	**Figure 22**

Figure 23a: Line Plot of 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195) Concentrations

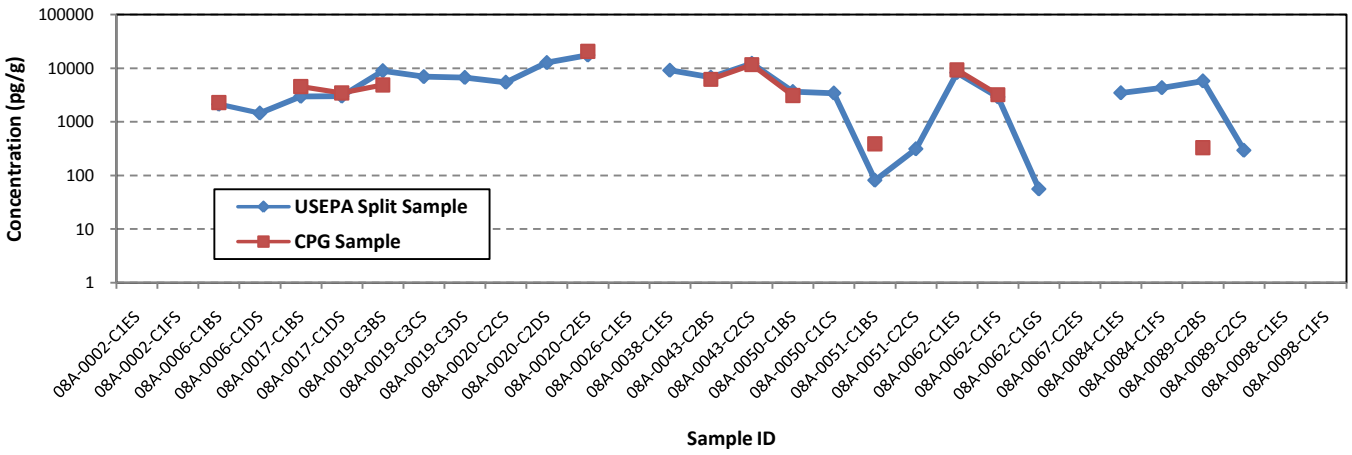


Figure 23b: Scatter Plot of 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195) Concentrations

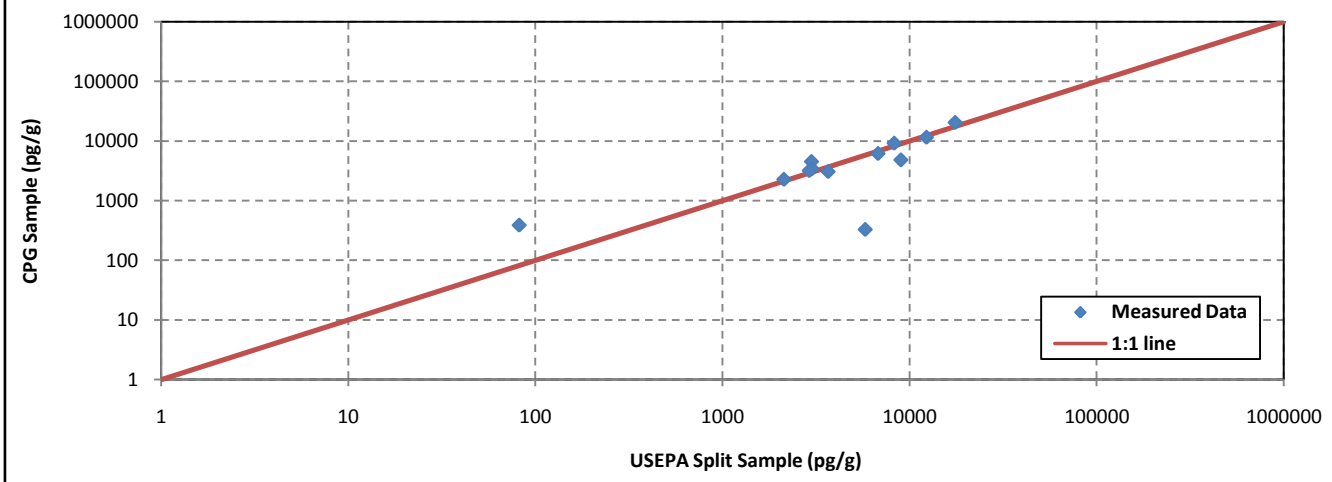
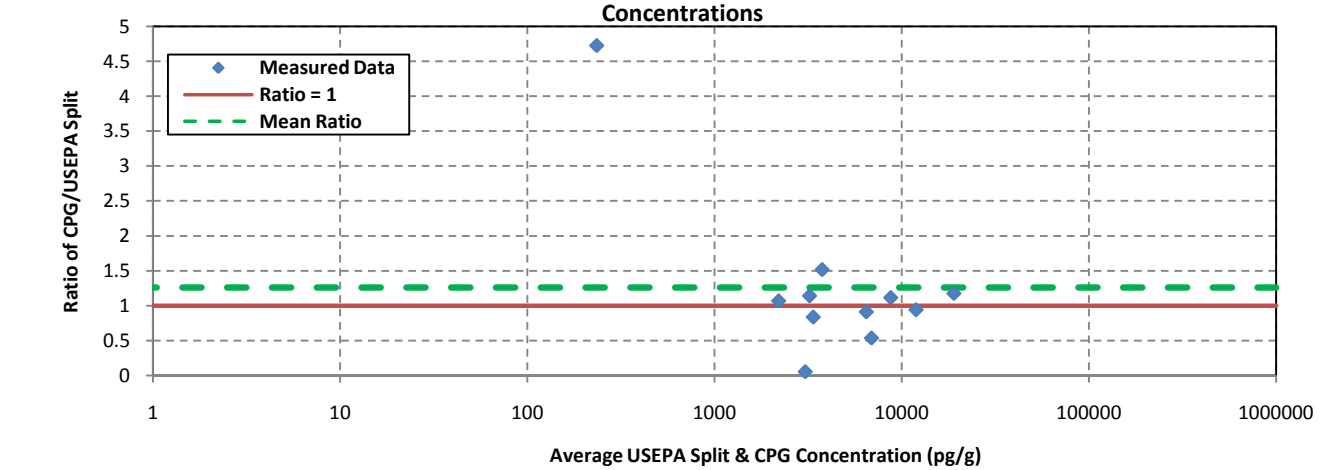


Figure 23c: Bland & Altman Plot of 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195) Ratios and Average Concentrations



US Army Corps of Engineers	Statistical Plots of 2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195) Concentrations	Figure 23

Figure 24a: Line Plot of Total Monochlorobiphenyls Concentrations

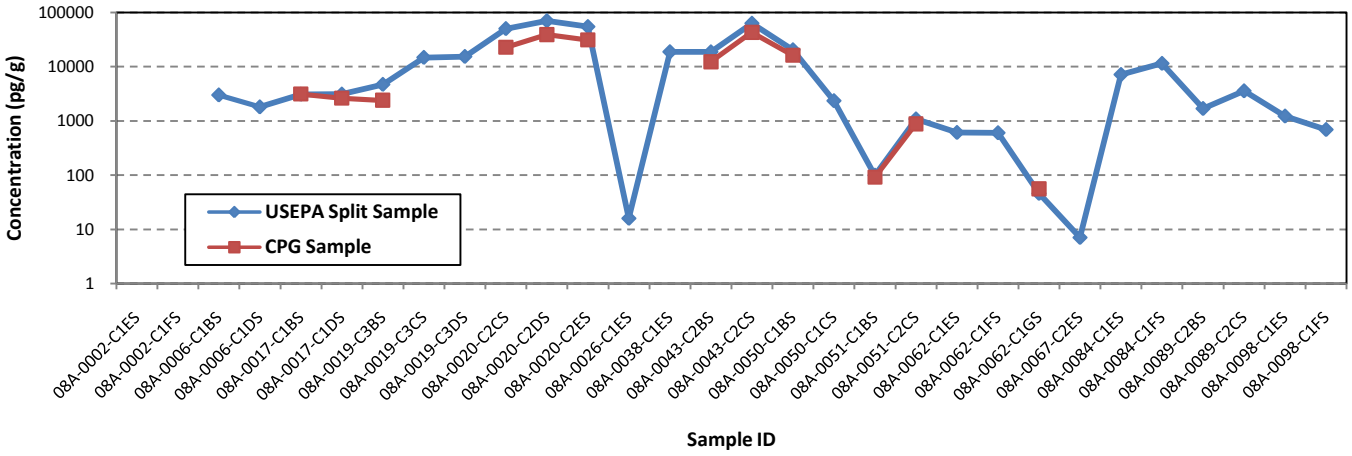


Figure 24b: Scatter Plot of Total Monochlorobiphenyls Concentrations

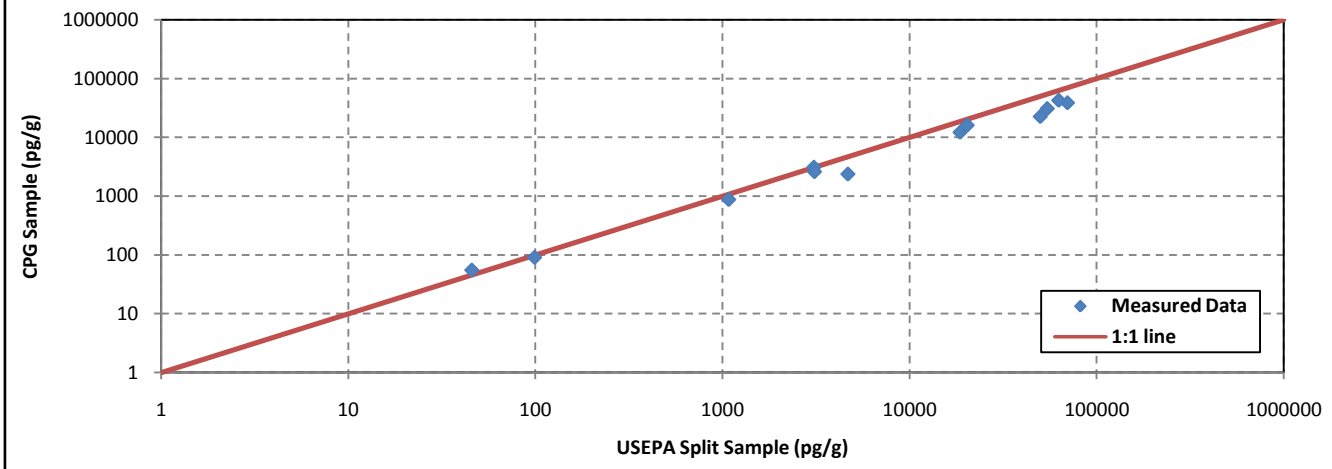


Figure 24c: Bland & Altman Plot of Total Monochlorobiphenyls Ratios and Average Concentrations

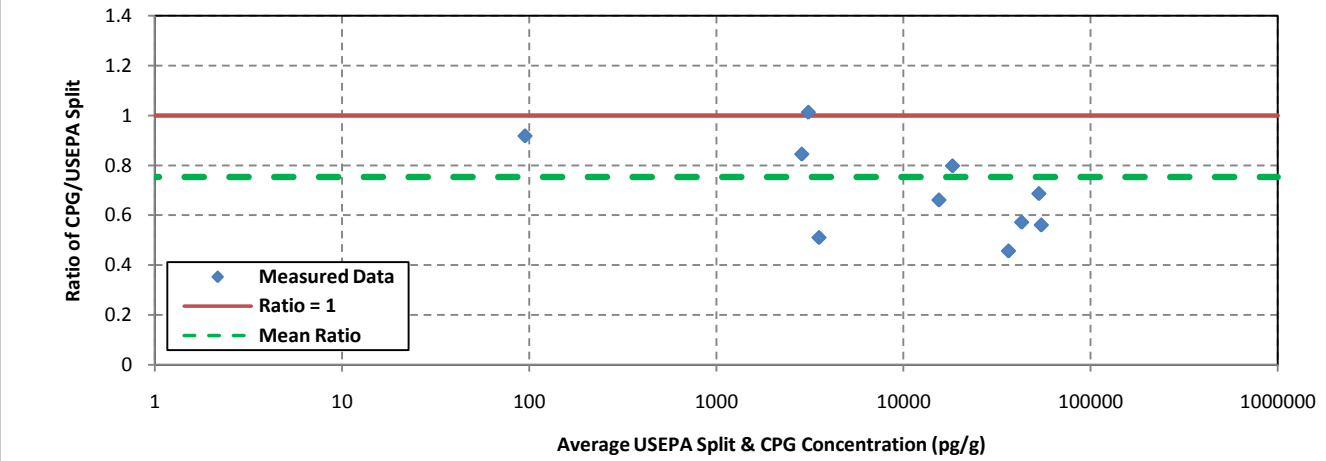


Figure 25a: Line Plot of Total Dichlorobiphenyls Concentrations

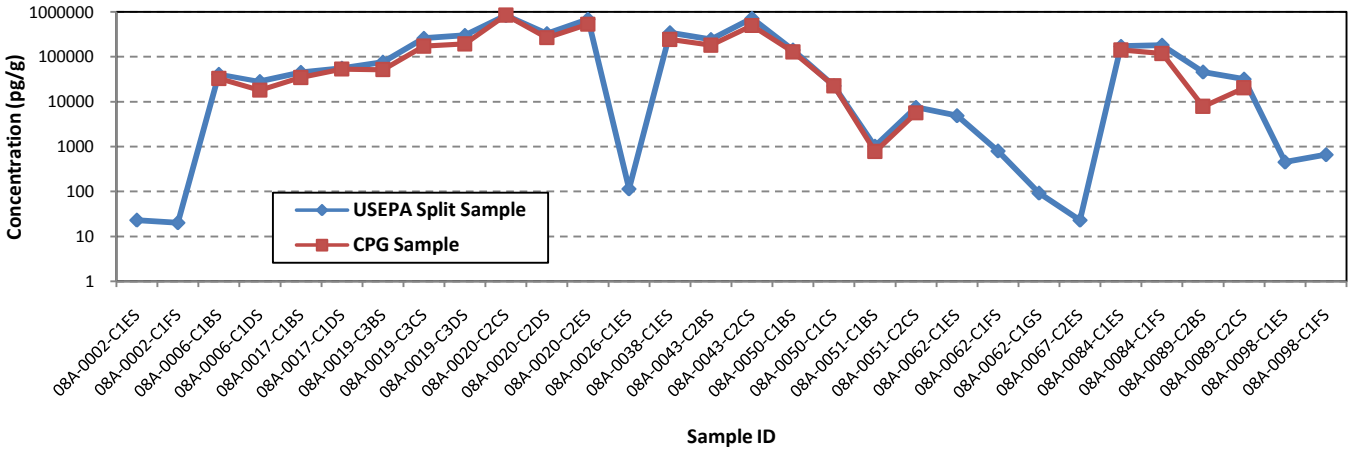


Figure 25b: Scatter Plot of Total Dichlorobiphenyls Concentrations

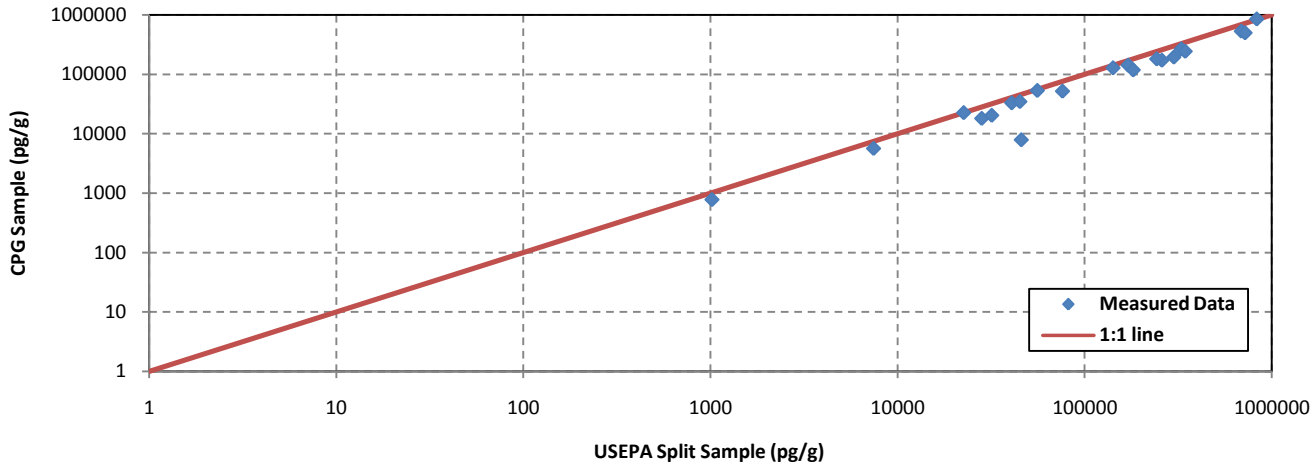


Figure 25c: Bland & Altman Plot of Total Dichlorobiphenyls Ratios and Average Concentrations

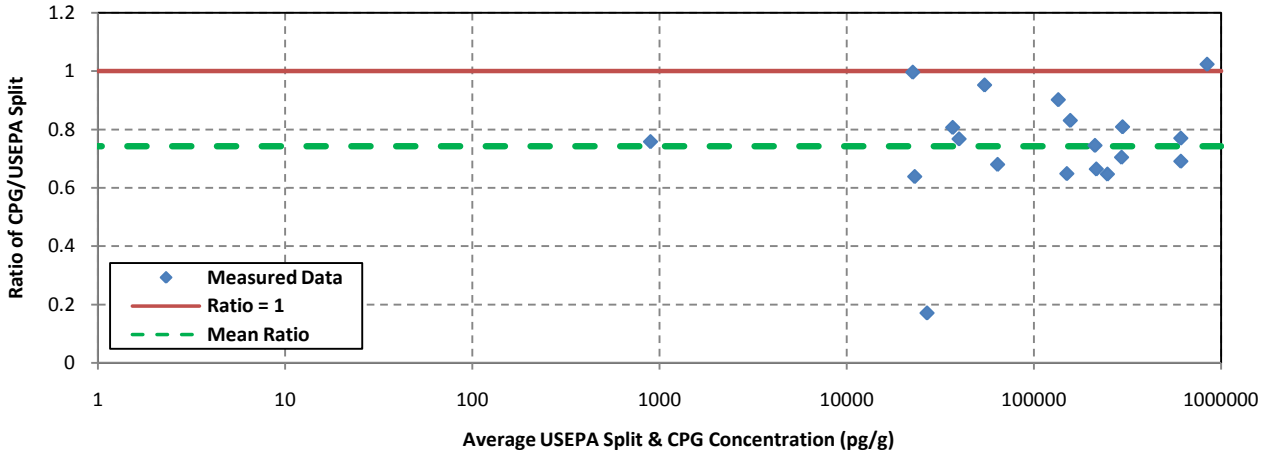


Figure 26a: Line Plot of Total Trichlorobiphenyls Concentrations

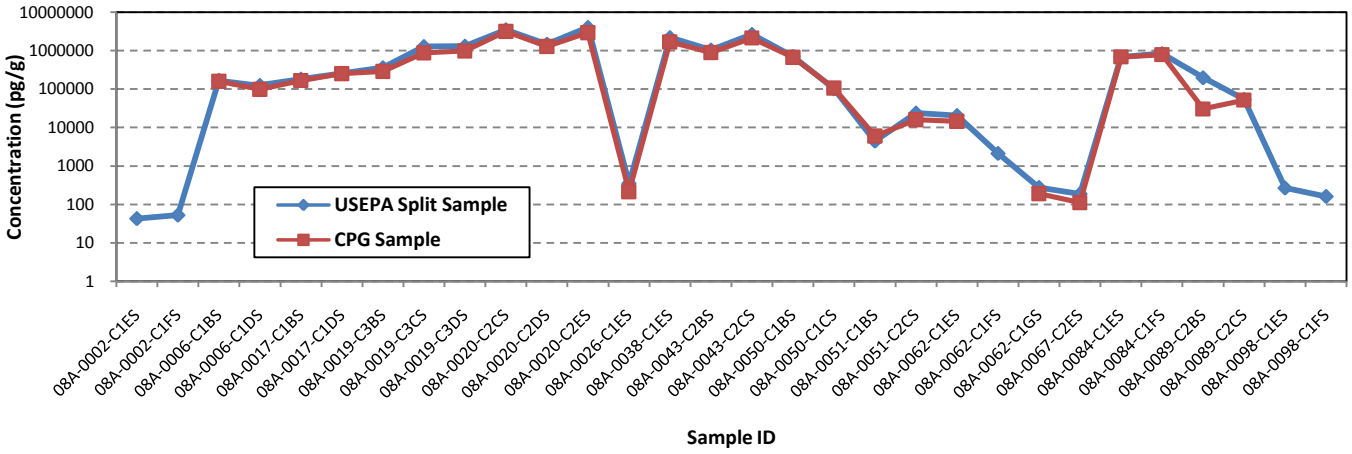


Figure 26b: Scatter Plot of Total Trichlorobiphenyls Concentrations

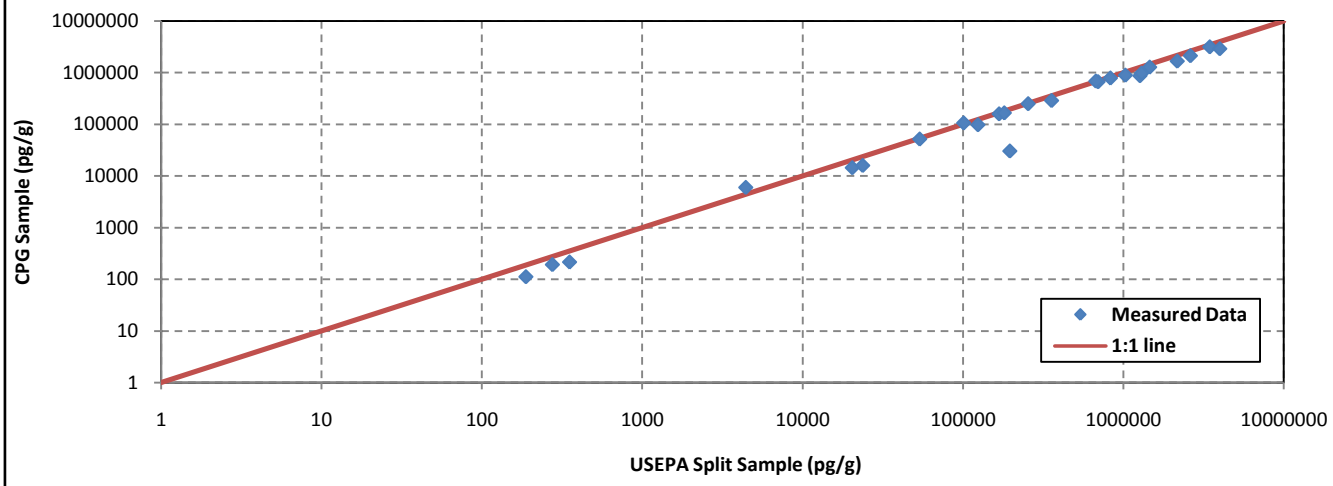


Figure 26c: Bland & Altman Plot of Total Trichlorobiphenyls Ratios and Average Concentrations

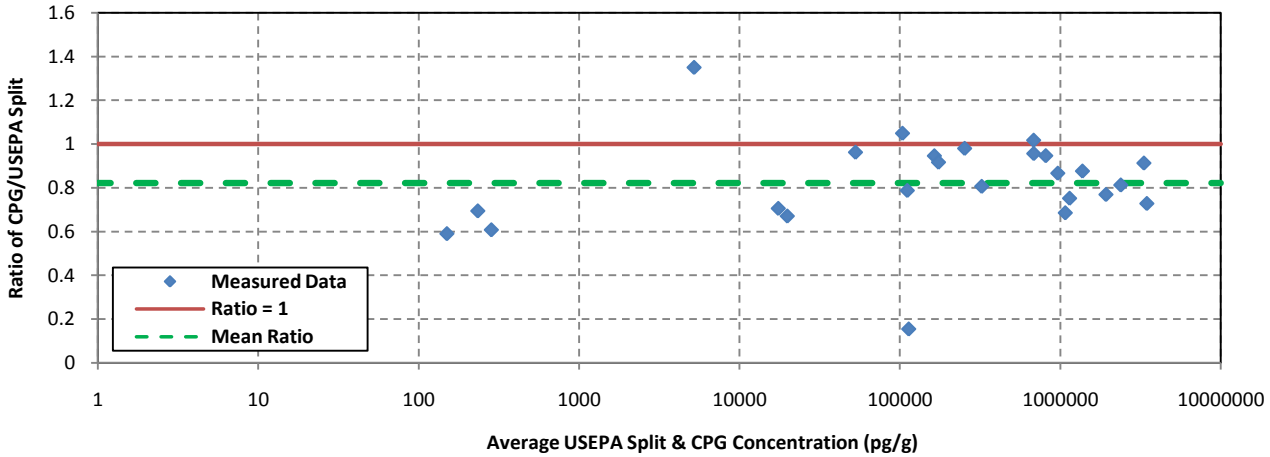


Figure 27a: Line Plot of Total Tetrachlorobiphenyls Concentrations

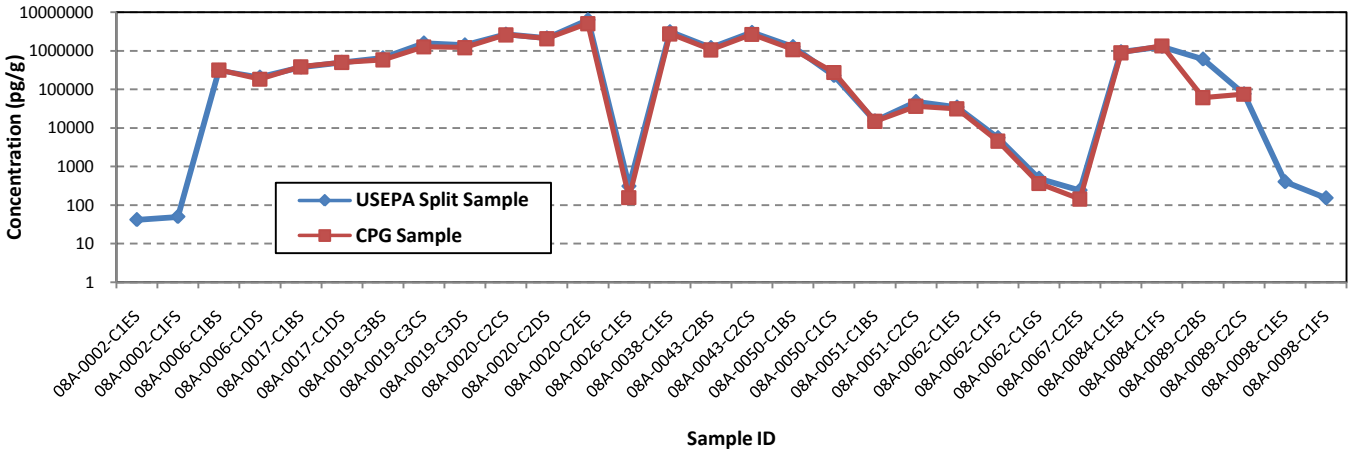


Figure 27b: Scatter Plot of Total Tetrachlorobiphenyls Concentrations

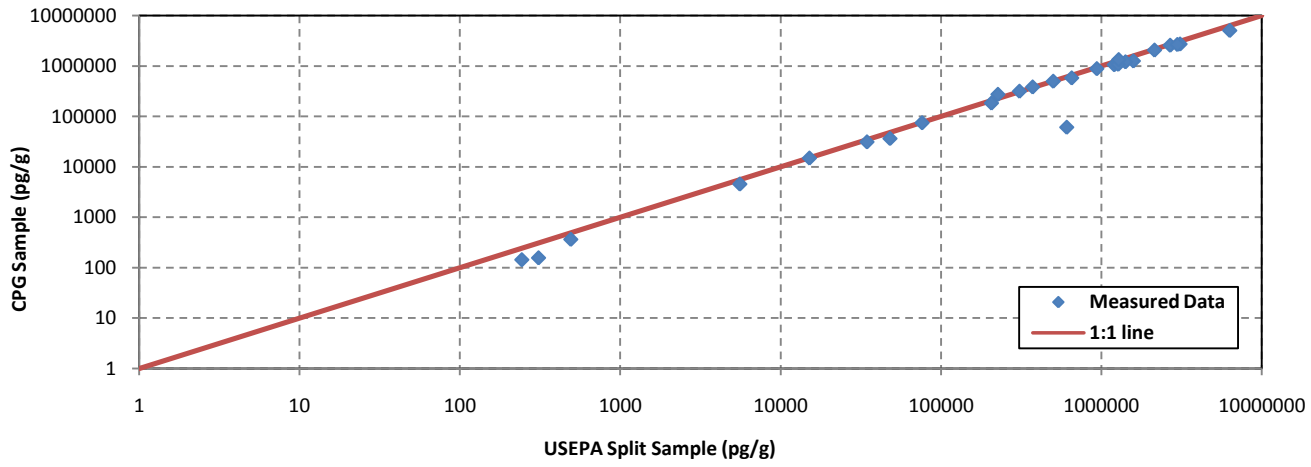
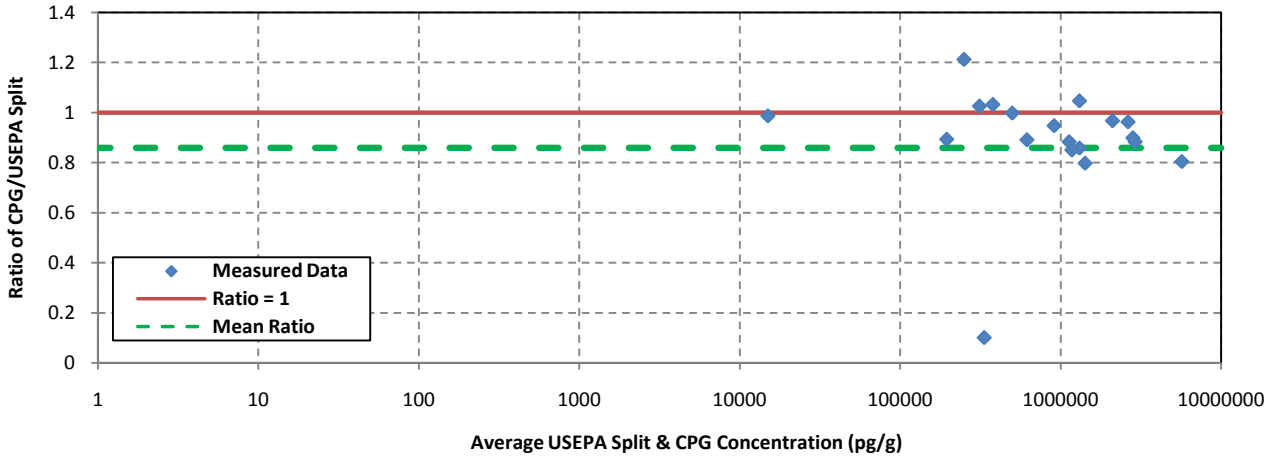


Figure 27c: Bland & Altman Plot of Total Tetrachlorobiphenyls Ratios and Average Concentrations



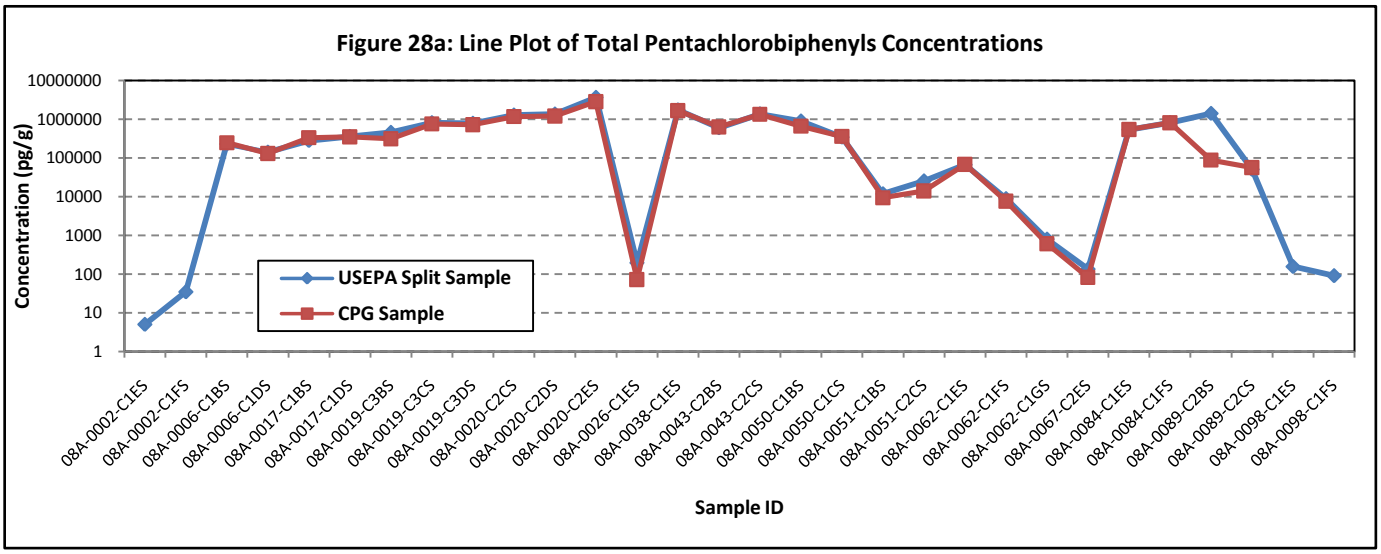


Figure 28a: Line Plot of Total Pentachlorobiphenyls Concentrations
Concentration (pg/g)
10000000
1000000
100000
10000
1000
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C1BS
08A-0006-C1DS
08A-0017-C1BS
08A-0017-C1DS
08A-0019-C3BS
08A-0019-C3CS
08A-0019-C3DS
08A-0020-C2CS
08A-0020-C2DS
08A-0020-C2ES
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C2BS
08A-0043-C2CS
08A-0050-C1BS
08A-0050-C1CS
08A-0051-C1BS
08A-0051-C2CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2BS
08A-0089-C2CS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

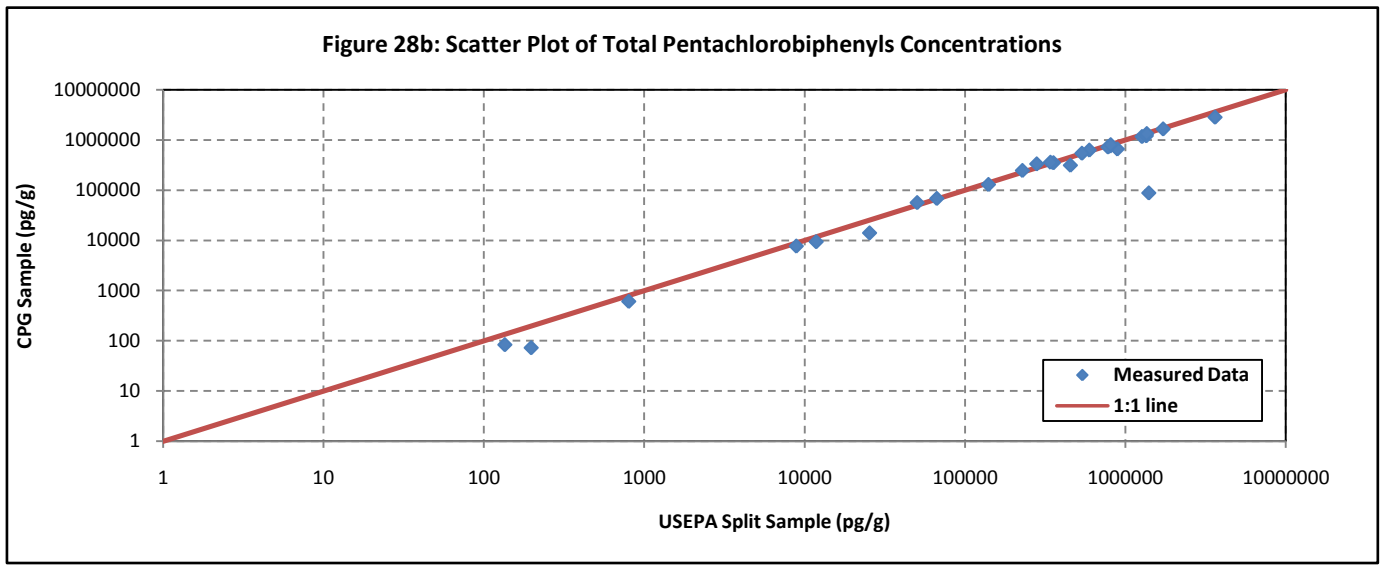


Figure 28b: Scatter Plot of Total Pentachlorobiphenyls Concentrations
CPG Sample (pg/g)
10000000
1000000
100000
10000
1000
100
10
1
Measured Data
1:1 line
1
10
100
1000
10000
100000
1000000
10000000
USEPA Split Sample (pg/g)

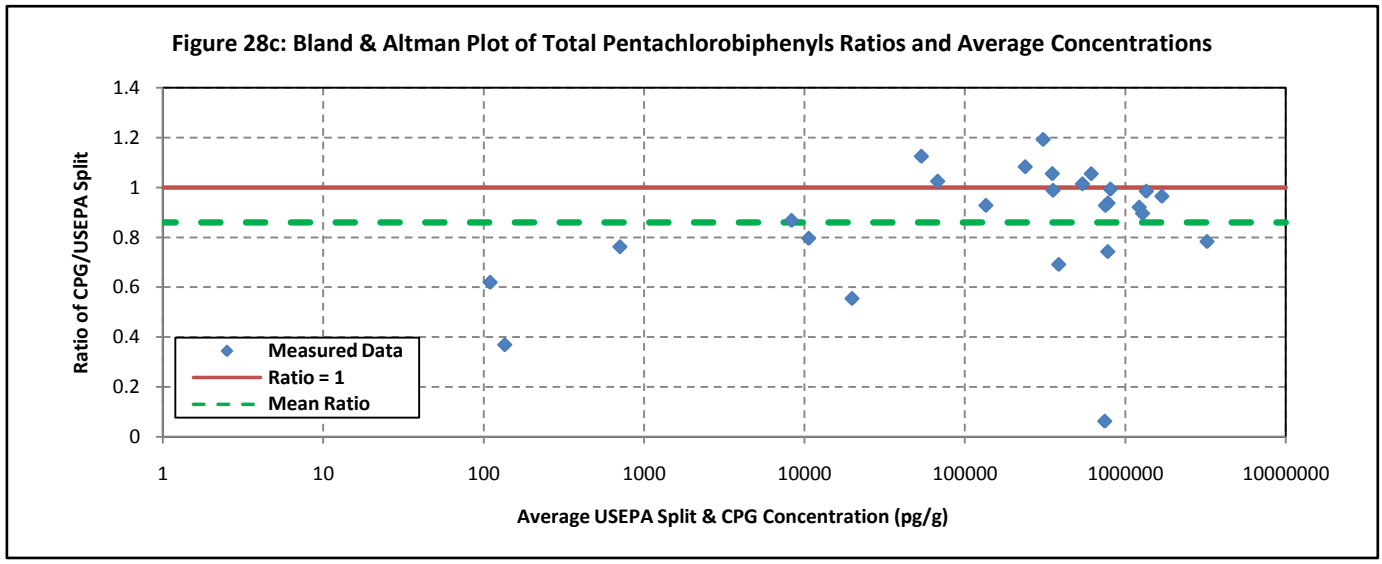


Figure 28c: Bland & Altman Plot of Total Pentachlorobiphenyls Ratios and Average Concentrations
Ratio of CPG/USEPA Split
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
1000
10000
100000
1000000
10000000
Average USEPA Split & CPG Concentration (pg/g)

Figure 29a: Line Plot of Total Hexachlorobiphenyls Concentrations

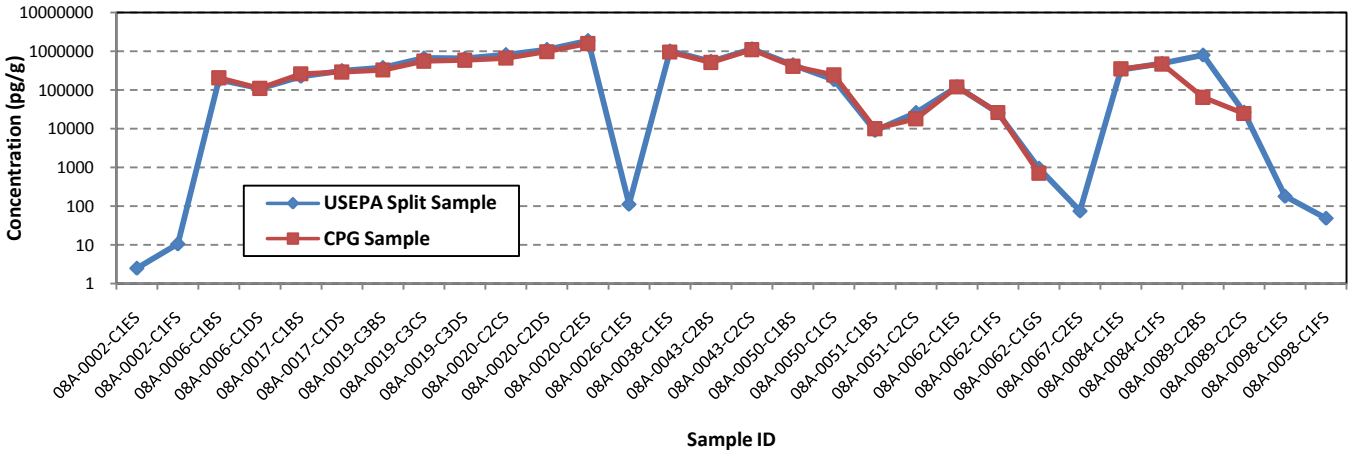


Figure 29b: Scatter Plot of Total Hexachlorobiphenyls Concentrations

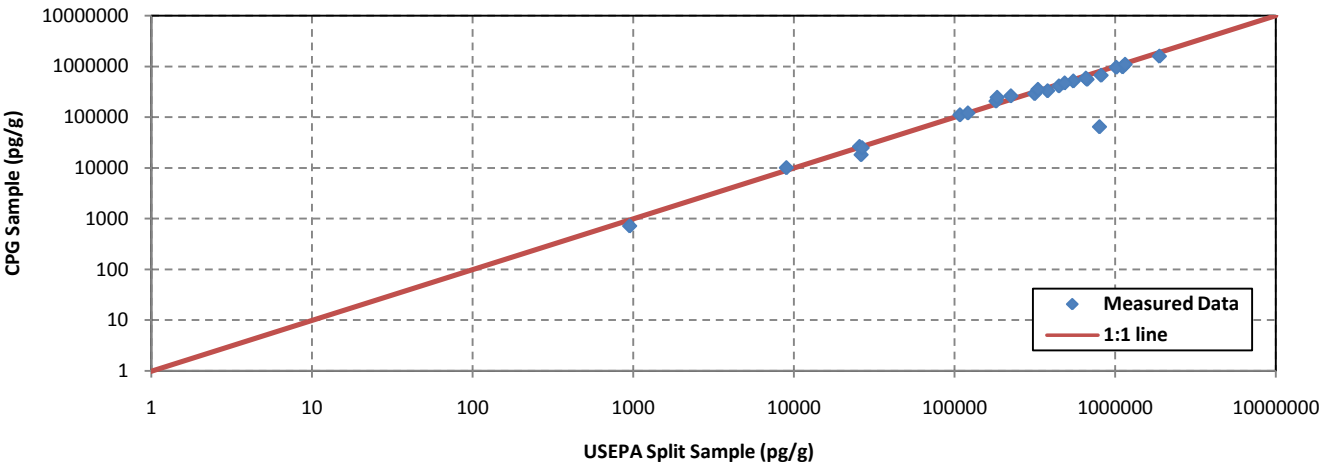


Figure 29c: Bland & Altman Plot of Total Hexachlorobiphenyls Ratios and Average Concentrations

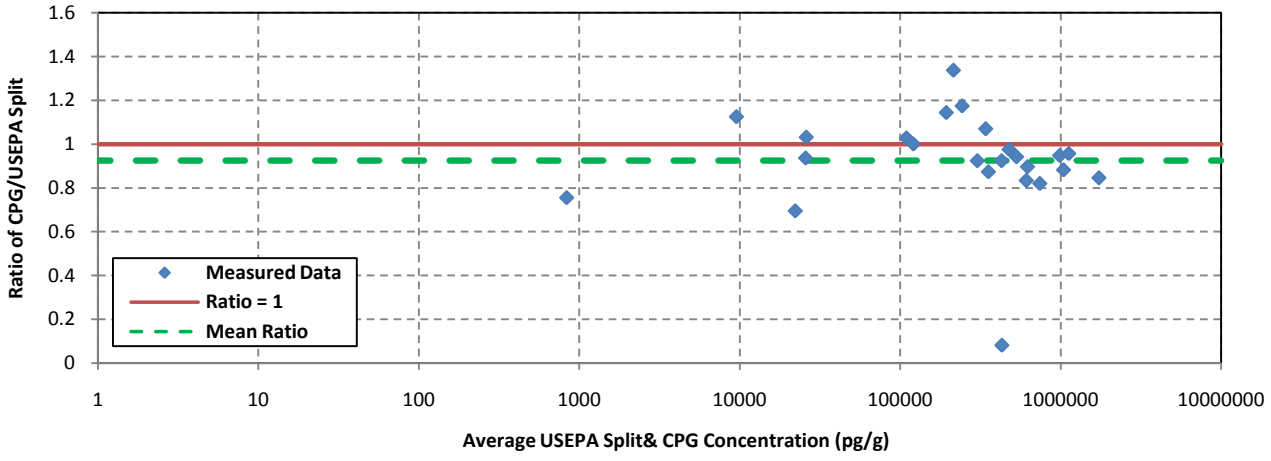


Figure 30a: Line Plot of Total Heptachlorobiphenyls Concentrations

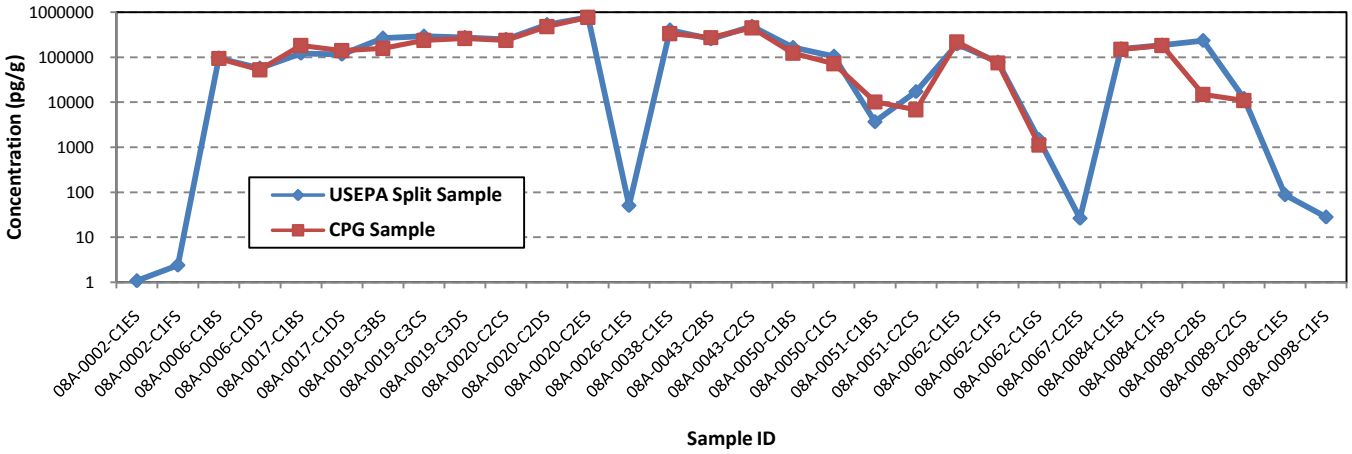


Figure 30b: Scatter Plot of Total Heptachlorobiphenyls Concentrations

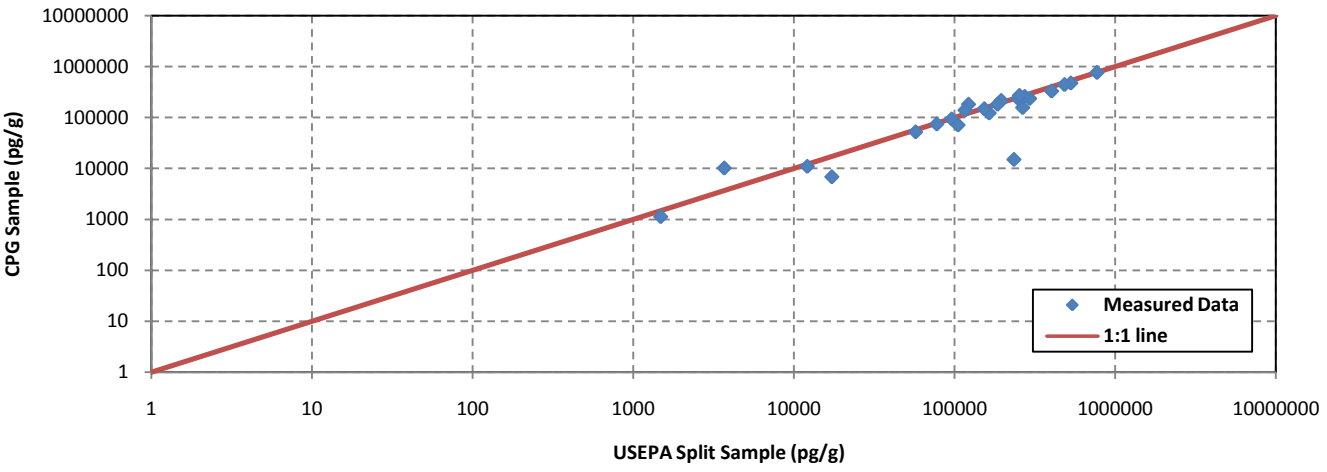


Figure 30c: Bland & Altman Plot of Total Heptachlorobiphenyls Ratios and Average Concentrations

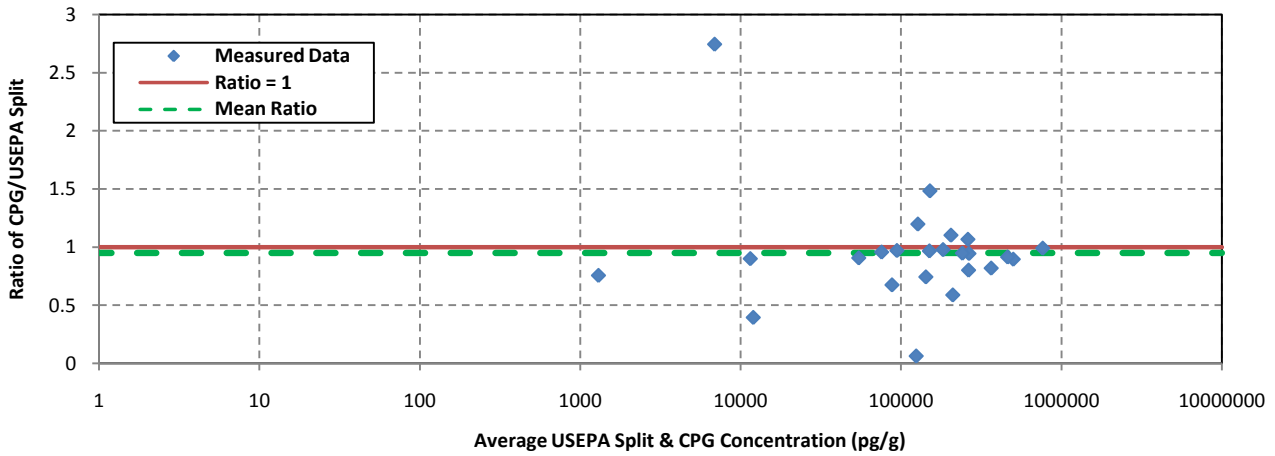


Figure 31a: Line Plot of Total Octachlorobiphenyls Concentrations

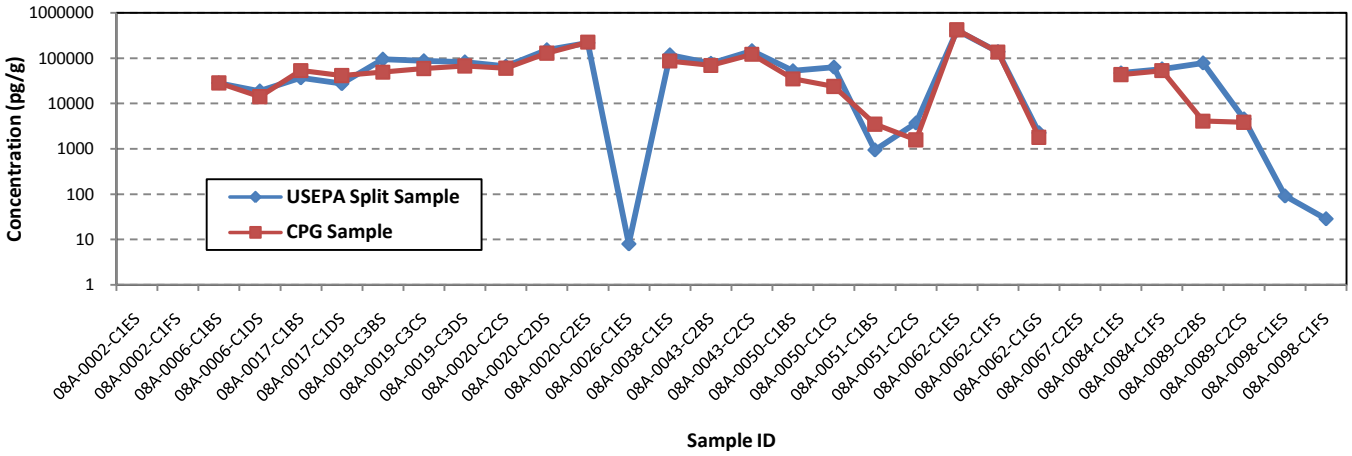


Figure 31b: Scatter Plot of Total Octachlorobiphenyls Concentrations

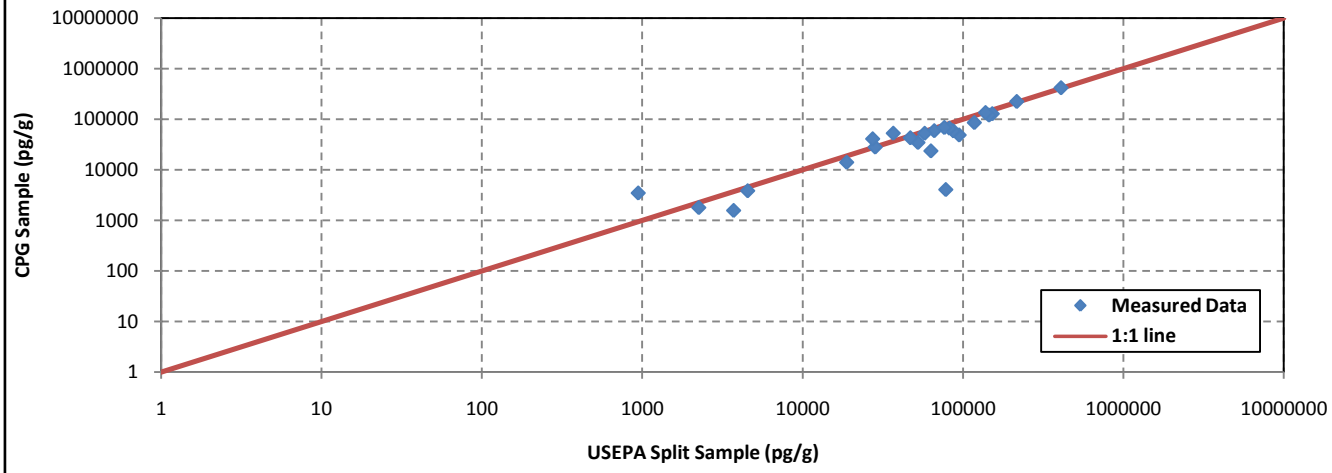


Figure 31c: Bland & Altman Plot of Total Octachlorobiphenyls Ratios and Average Concentrations

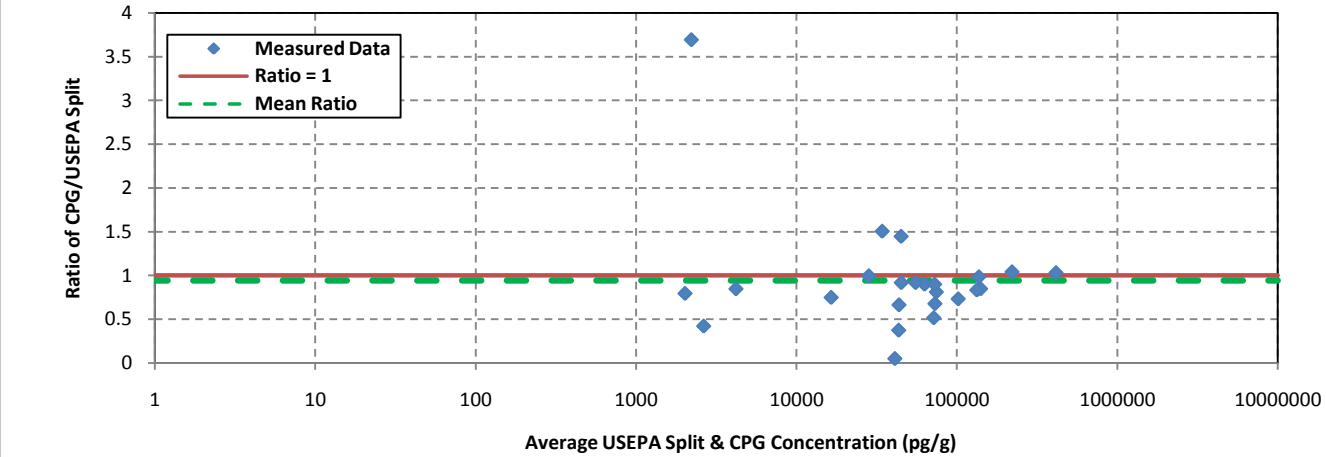


Figure 32a: Line Plot of Total Nonachlorobiphenyls Concentrations

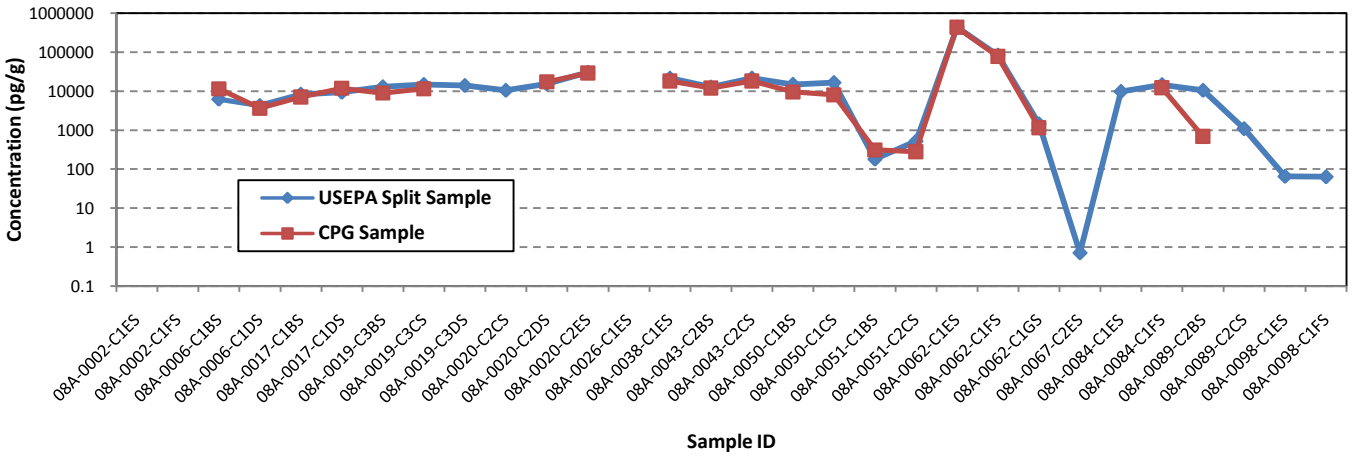


Figure 32b: Scatter Plot of Total Nonachlorobiphenyls Concentrations

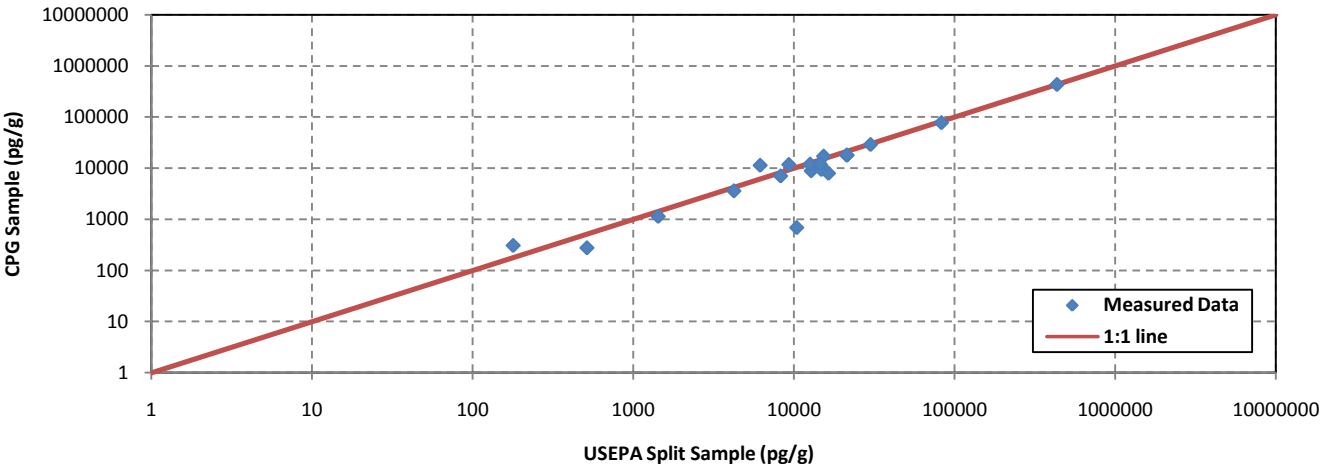


Figure 32c: Bland & Altman Plot of Total Nonachlorobiphenyls Ratios and Average Concentrations

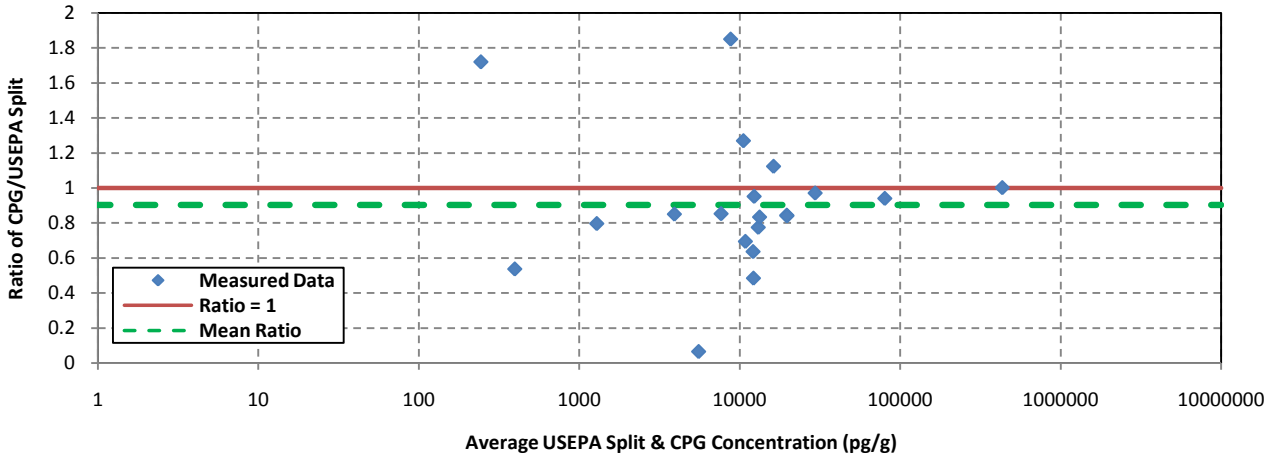


Figure 33a: Line Plot of Total PCBs Concentrations

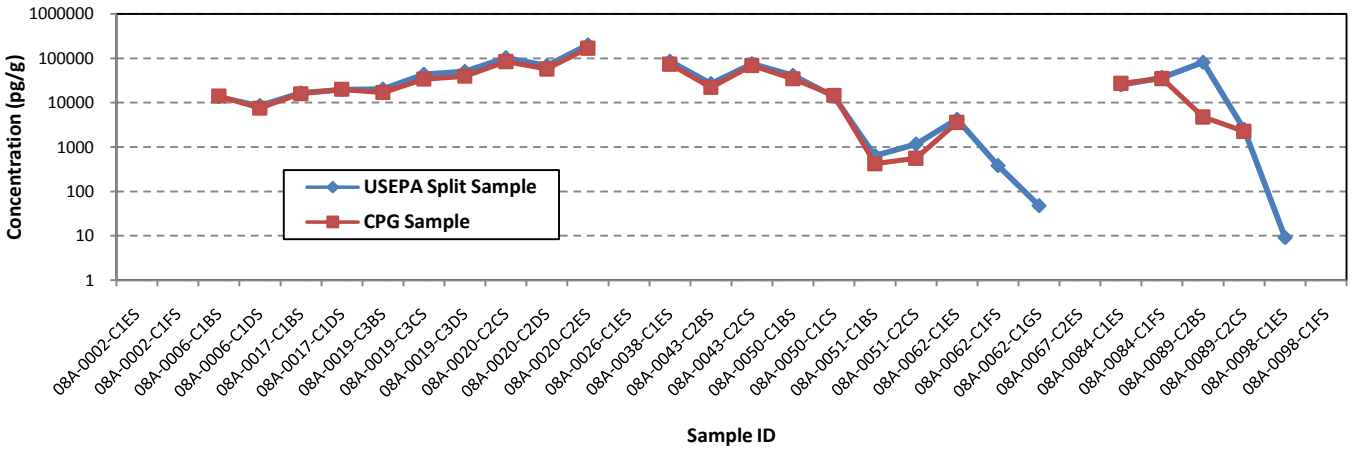


Figure 33b: Scatter Plot of Total PCBs Concentrations

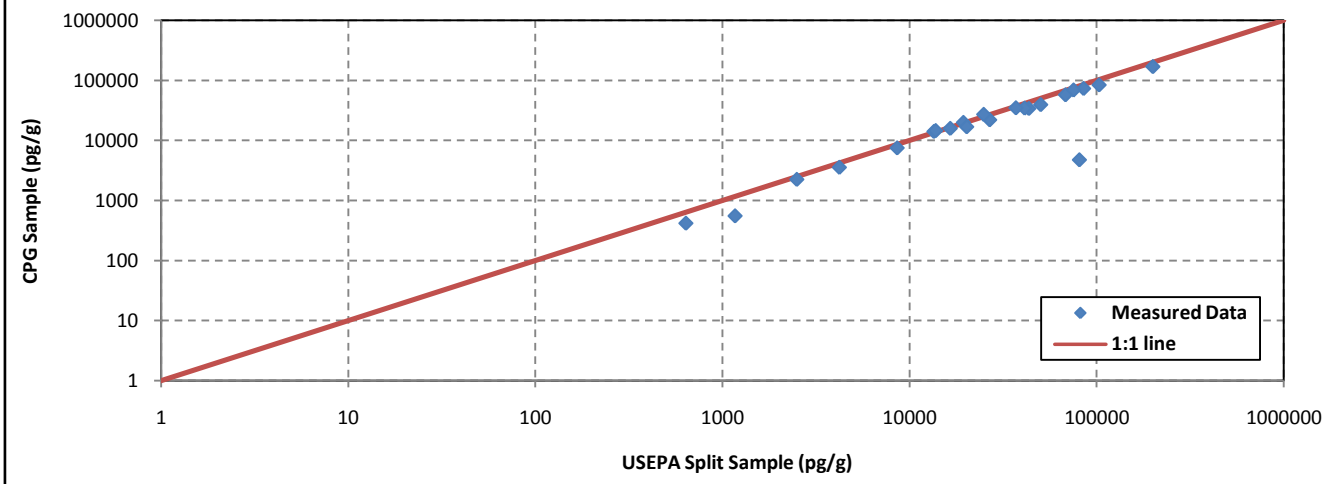
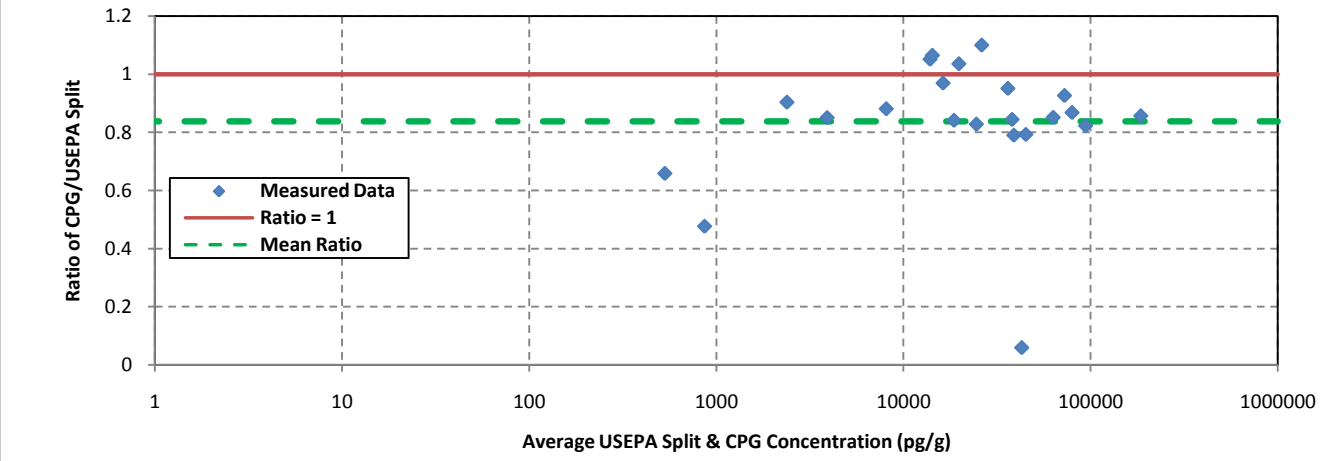


Figure 33c: Bland & Altman Plot of Total PCBs Ratios and Average Concentrations



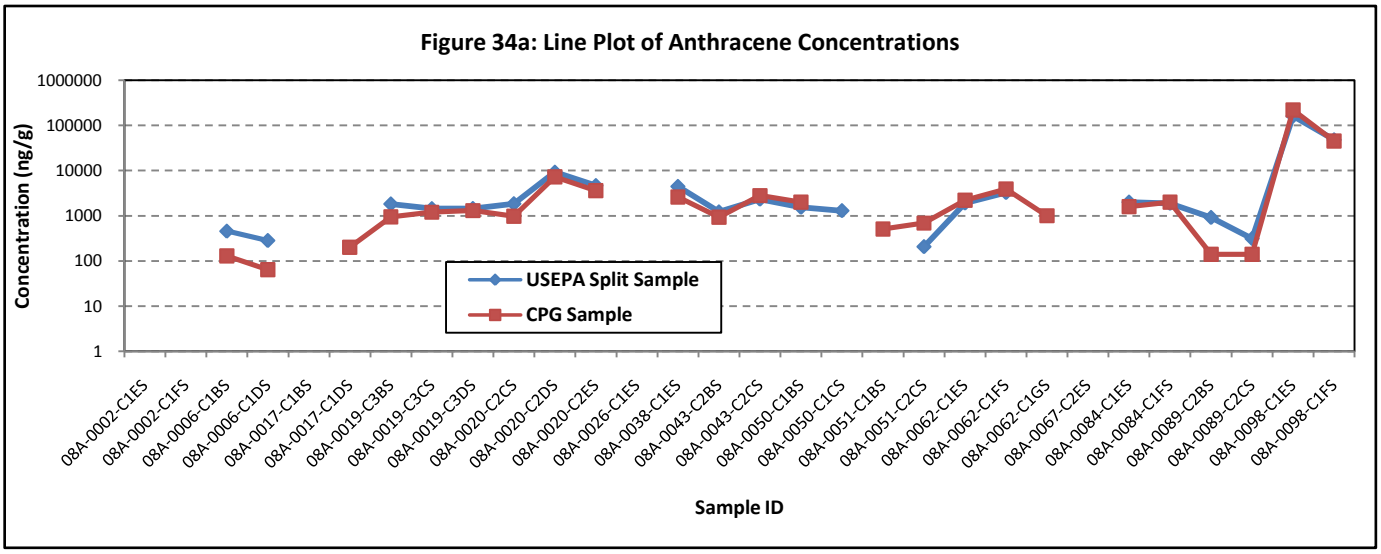


Figure 34a: Line Plot of Anthracene Concentrations
Concentration (ng/g)
1000000
100000
10000
1000
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C1BS
08A-0006-C1DS
08A-0017-C1BS
08A-0017-C1DS
08A-0019-C3BS
08A-0019-C3CS
08A-0019-C3DS
08A-0020-C2CS
08A-0020-C2DS
08A-0020-C2ES
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C2BS
08A-0043-C2CS
08A-0050-C1BS
08A-0050-C1CS
08A-0051-C1BS
08A-0051-C2CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2BS
08A-0089-C2CS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

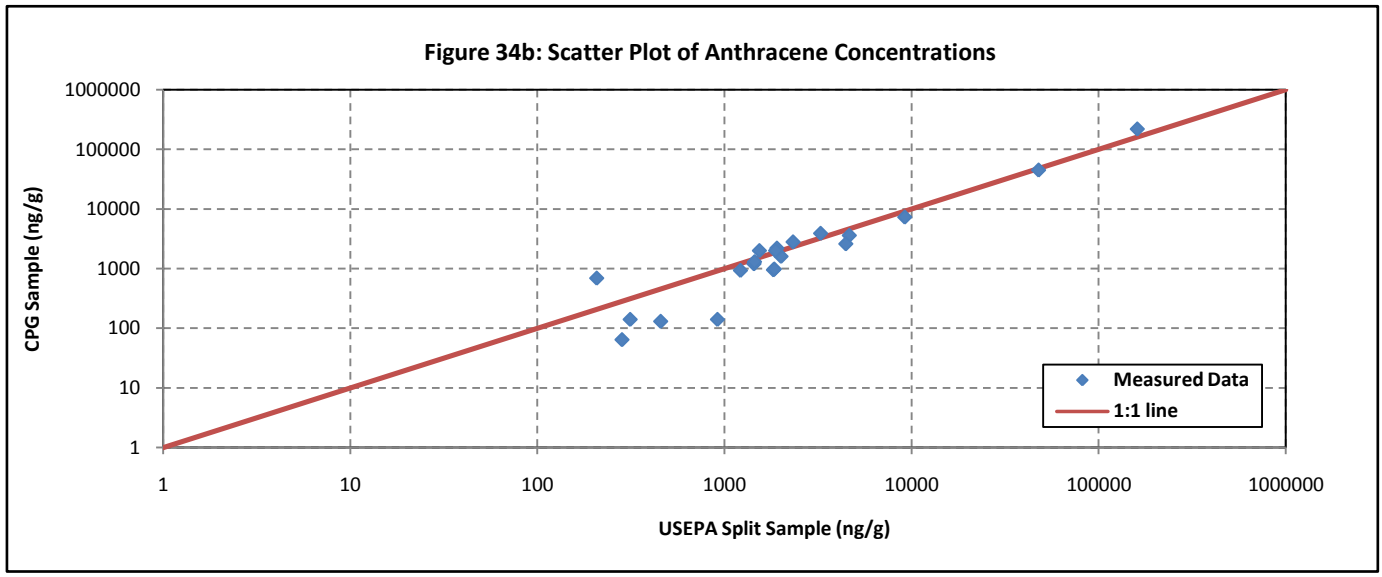


Figure 34b: Scatter Plot of Anthracene Concentrations
CPG Sample (ng/g)
1000000
100000
10000
1000
100
10
1
Measured Data
1:1 line
1
10
100
1000
10000
100000
1000000
USEPA Split Sample (ng/g)

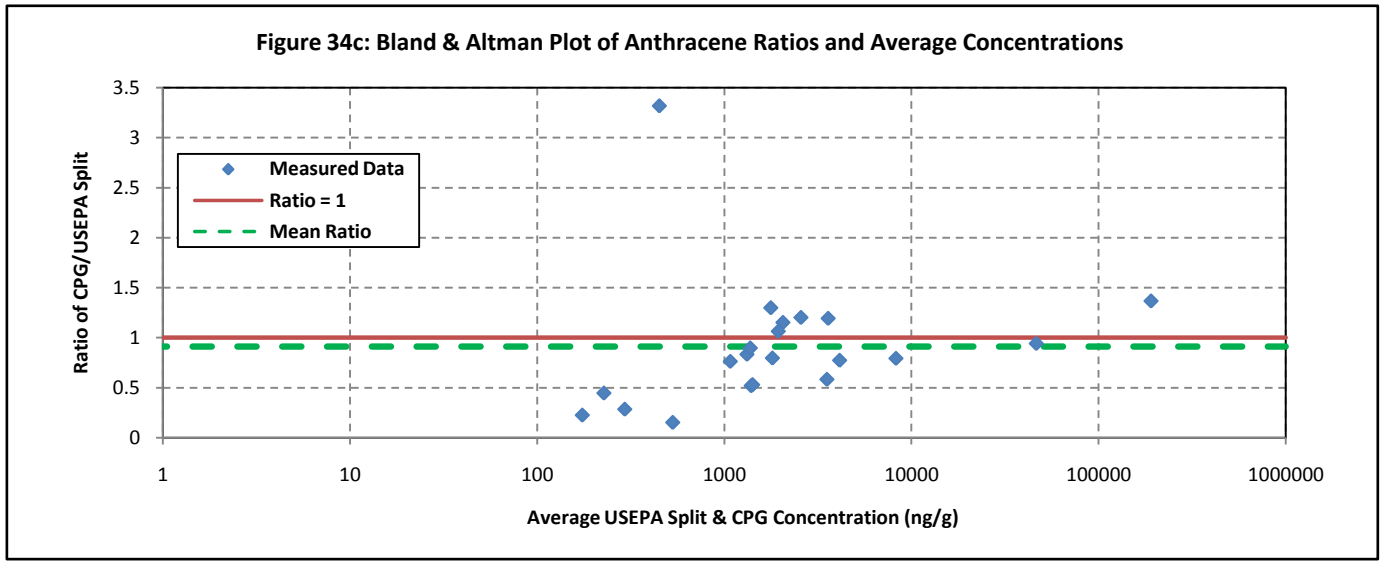


Figure 34c: Bland & Altman Plot of Anthracene Ratios and Average Concentrations
Ratio of CPG/USEPA Split
3.5
3
2.5
2
1.5
1
0.5
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
1000
10000
100000
1000000
Average USEPA Split & CPG Concentration (ng/g)

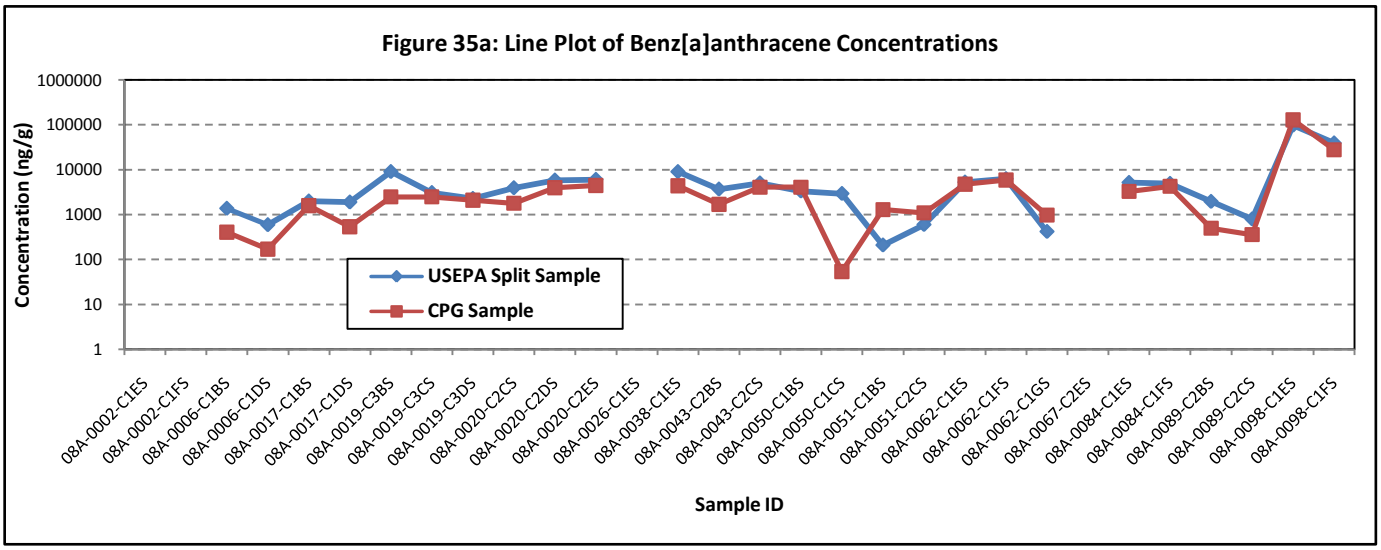


Figure 35a: Line Plot of Benz[a]anthracene Concentrations
Concentration (ng/g)
1000000
100000
10000
1000
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C1BS
08A-0006-C1DS
08A-0017-C1BS
08A-0017-C1DS
08A-0019-C3BS
08A-0019-C3CS
08A-0019-C3DS
08A-0020-C2CS
08A-0020-C2DS
08A-0020-C2ES
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C2BS
08A-0043-C2CS
08A-0050-C1BS
08A-0050-C1CS
08A-0051-C1BS
08A-0051-C2CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2BS
08A-0089-C2CS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

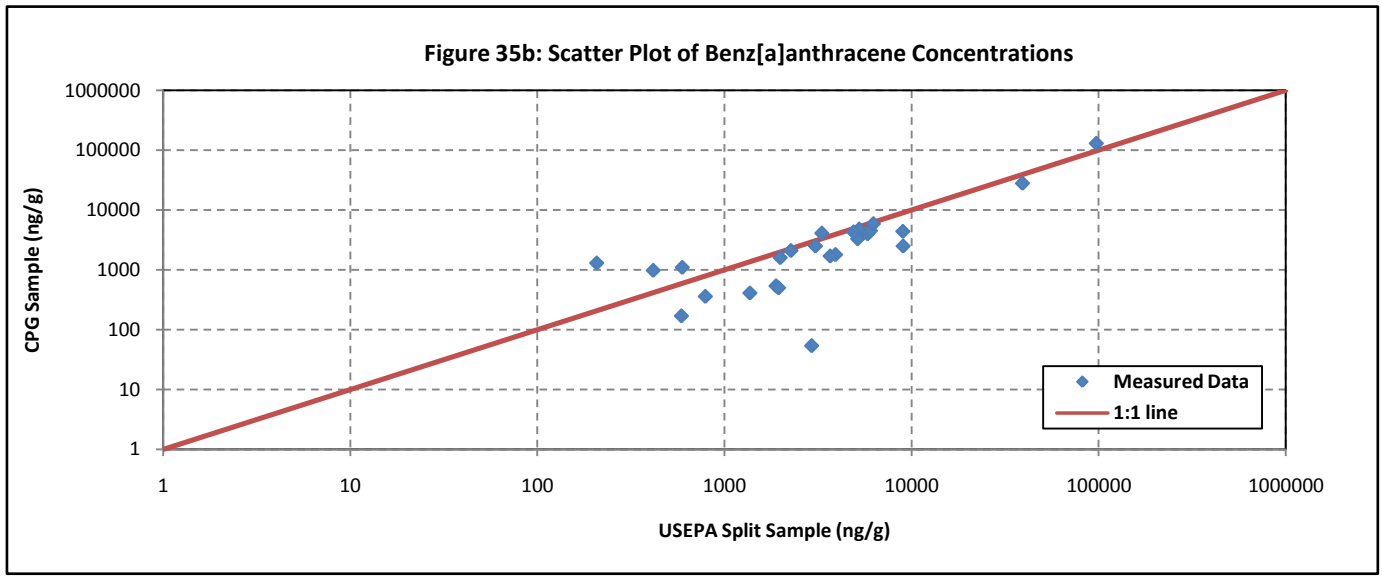


Figure 35b: Scatter Plot of Benz[a]anthracene Concentrations
CPG Sample (ng/g)
1000000
100000
10000
1000
100
10
1
Measured Data
1:1 line
1
10
100
1000
10000
100000
1000000
USEPA Split Sample (ng/g)

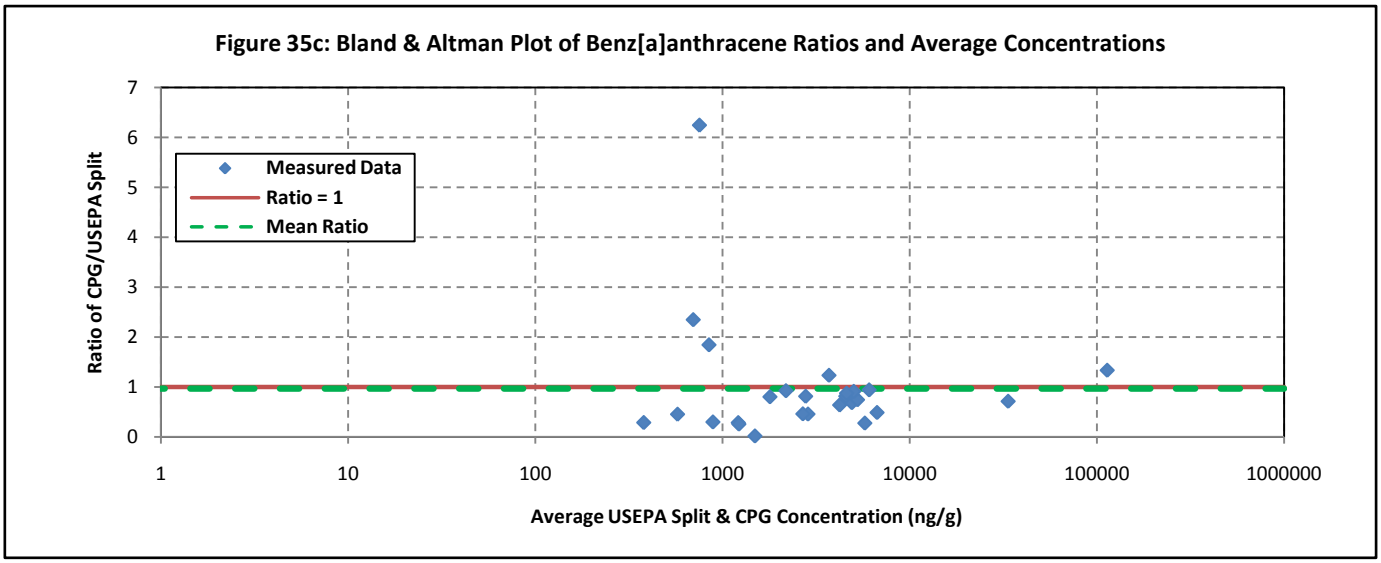


Figure 35c: Bland & Altman Plot of Benz[a]anthracene Ratios and Average Concentrations
Ratio of CPG/USEPA Split
7
6
5
4
3
2
1
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
1000
10000
100000
1000000
Average USEPA Split & CPG Concentration (ng/g)

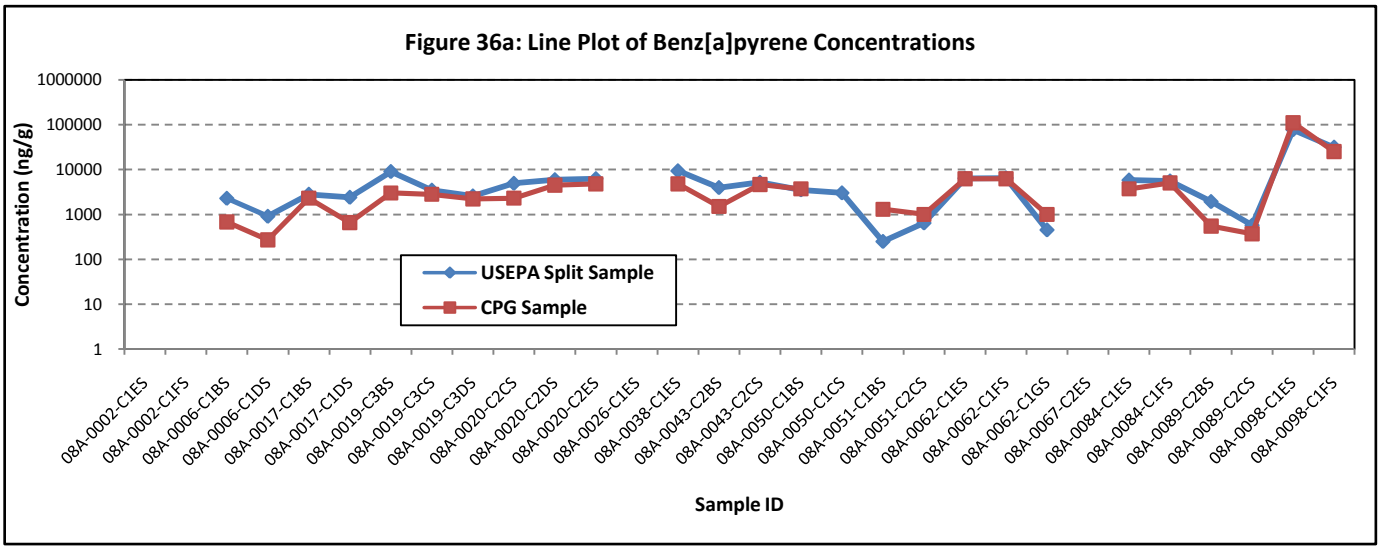


Figure 36a: Line Plot of Benz[a]pyrene Concentrations
Concentration (ng/g)
1000000
100000
10000
1000
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C1BS
08A-0006-C1DS
08A-0017-C1BS
08A-0017-C1DS
08A-0019-C3BS
08A-0019-C3CS
08A-0019-C3DS
08A-0020-C2CS
08A-0020-C2DS
08A-0020-C2ES
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C2BS
08A-0043-C2CS
08A-0050-C1BS
08A-0050-C1CS
08A-0051-C1BS
08A-0051-C2CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2BS
08A-0089-C2CS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

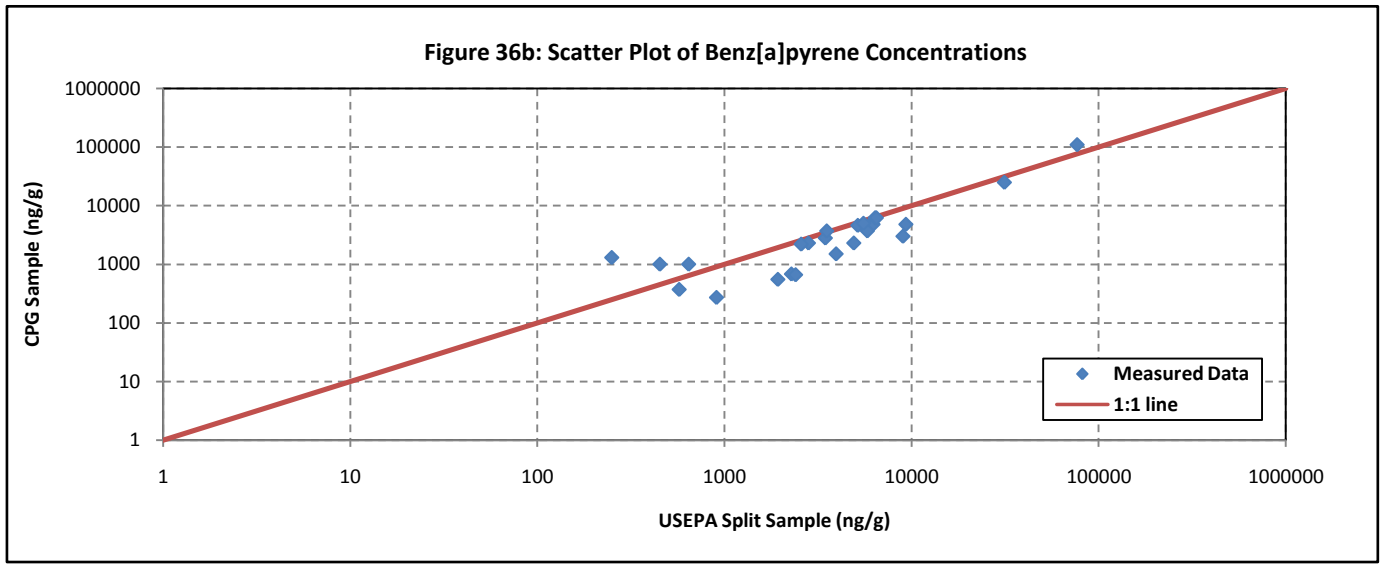


Figure 36b: Scatter Plot of Benz[a]pyrene Concentrations
CPG Sample (ng/g)
1000000
100000
10000
1000
100
10
1
Measured Data
1:1 line
1
10
100
1000
10000
100000
1000000
USEPA Split Sample (ng/g)

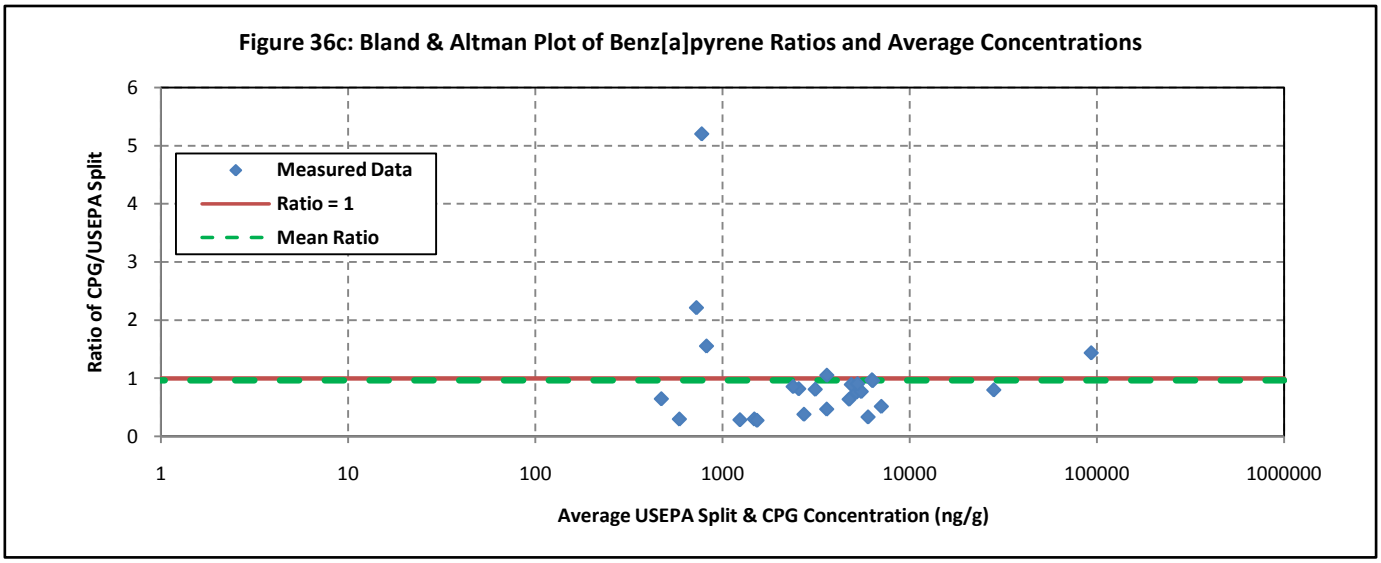


Figure 36c: Bland & Altman Plot of Benz[a]pyrene Ratios and Average Concentrations
Ratio of CPG/USEPA Split
6
5
4
3
2
1
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
1000
10000
100000
1000000
Average USEPA Split & CPG Concentration (ng/g)

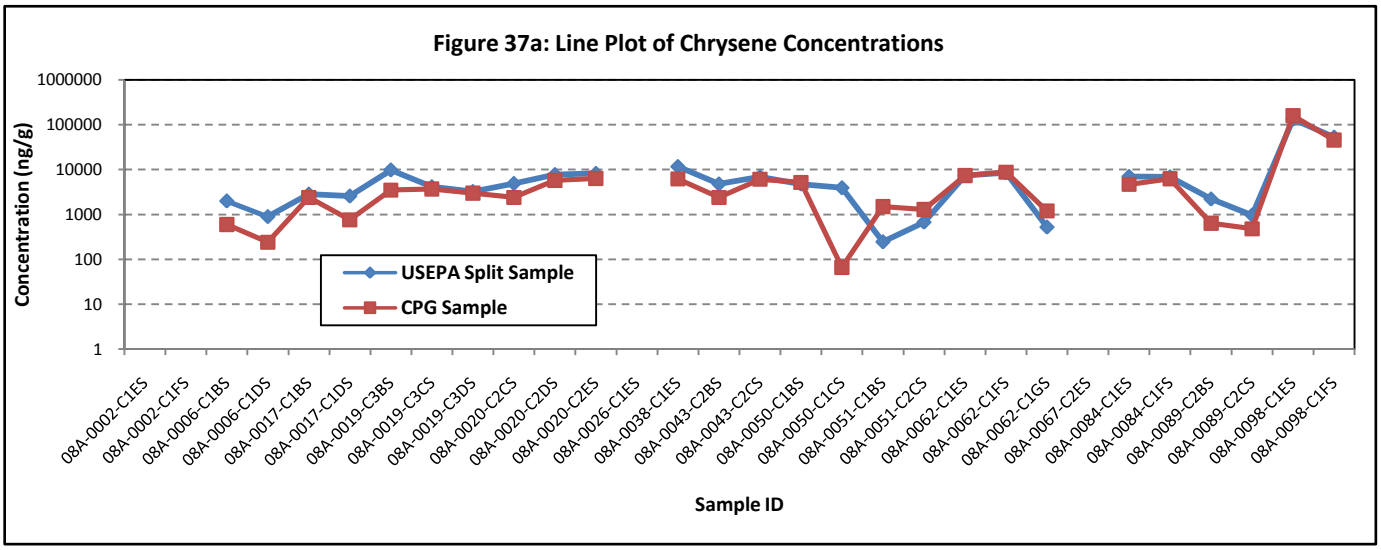


Figure 37a: Line Plot of Chrysene Concentrations
Concentration (ng/g)
1000000
100000
10000
1000
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C1BS
08A-0006-C1DS
08A-0017-C1BS
08A-0017-C1DS
08A-0019-C3BS
08A-0019-C3CS
08A-0019-C3DS
08A-0020-C2CS
08A-0020-C2DS
08A-0020-C2ES
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C2BS
08A-0043-C2CS
08A-0050-C1BS
08A-0050-C1CS
08A-0051-C1BS
08A-0051-C2CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2BS
08A-0089-C2CS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

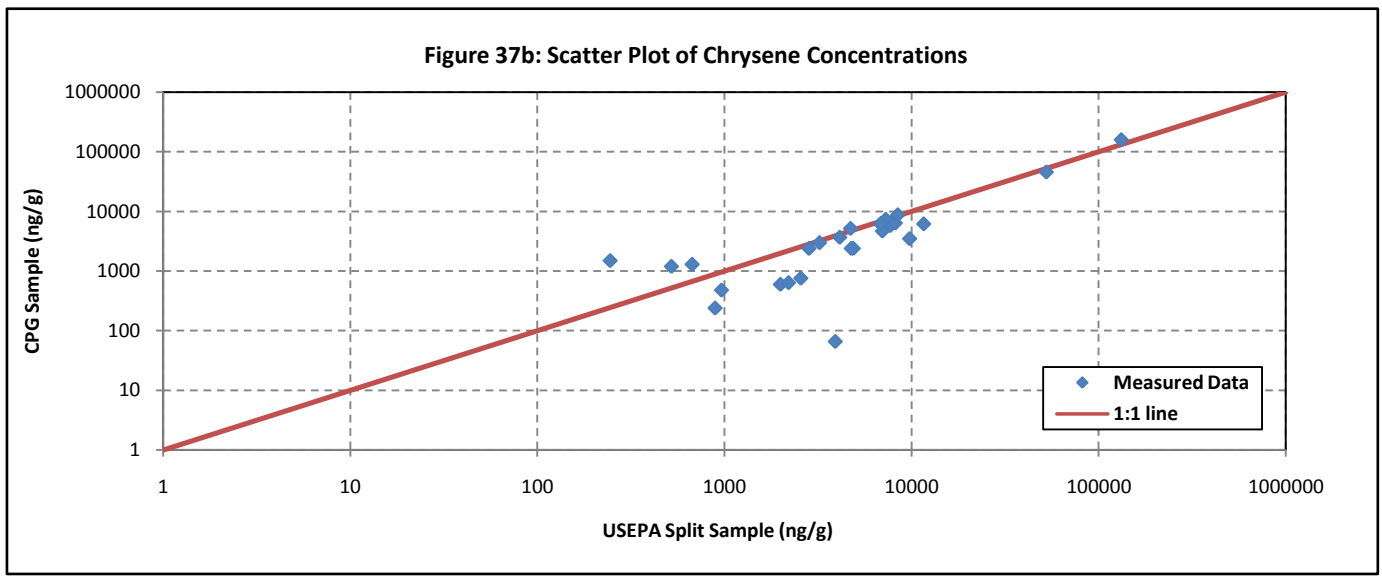


Figure 37b: Scatter Plot of Chrysene Concentrations
CPG Sample (ng/g)
1000000
100000
10000
1000
100
10
1
Measured Data
1:1 line
1
10
100
1000
10000
100000
1000000
USEPA Split Sample (ng/g)

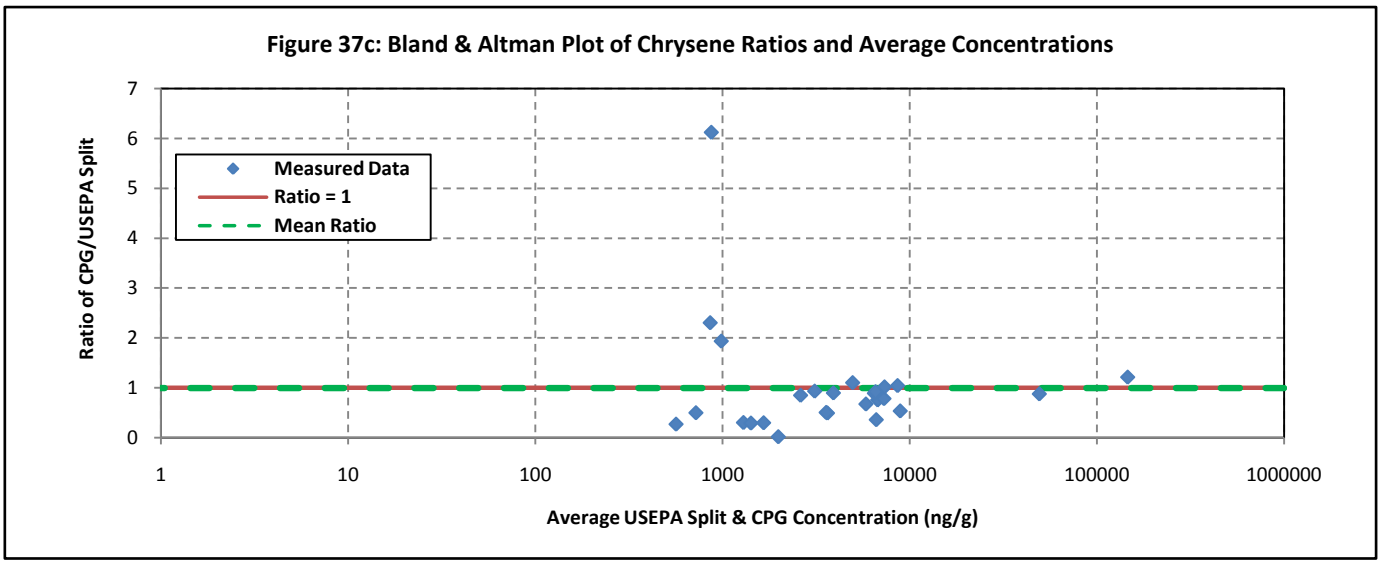


Figure 37c: Bland & Altman Plot of Chrysene Ratios and Average Concentrations
Ratio of CPG/USEPA Split
7
6
5
4
3
2
1
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
1000
10000
100000
1000000
Average USEPA Split & CPG Concentration (ng/g)

Figure 38a: Line Plot of Fluoranthene Concentrations

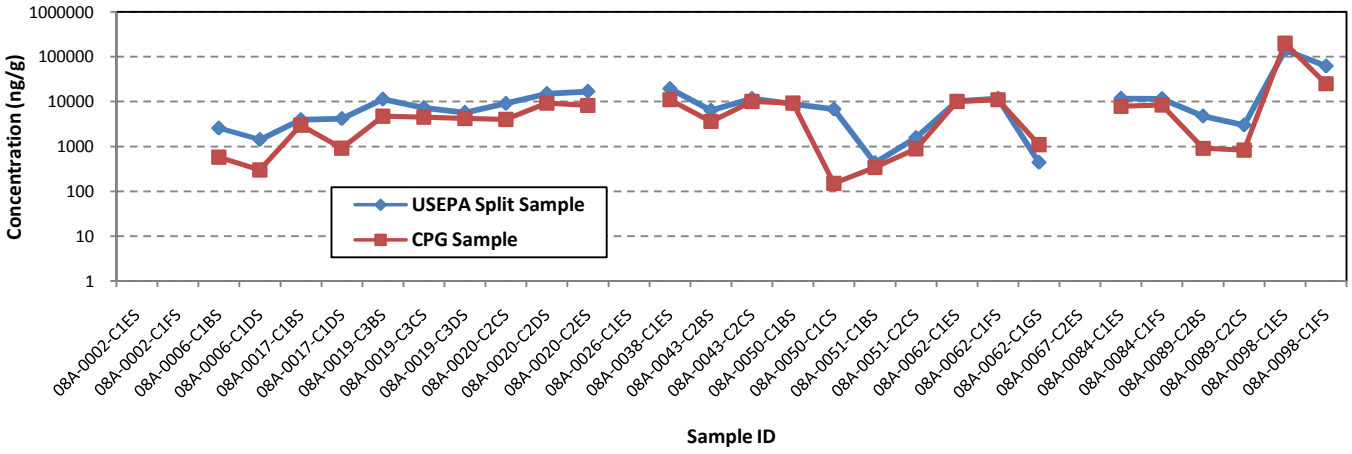


Figure 38b: Scatter Plot of Fluoranthene Concentrations

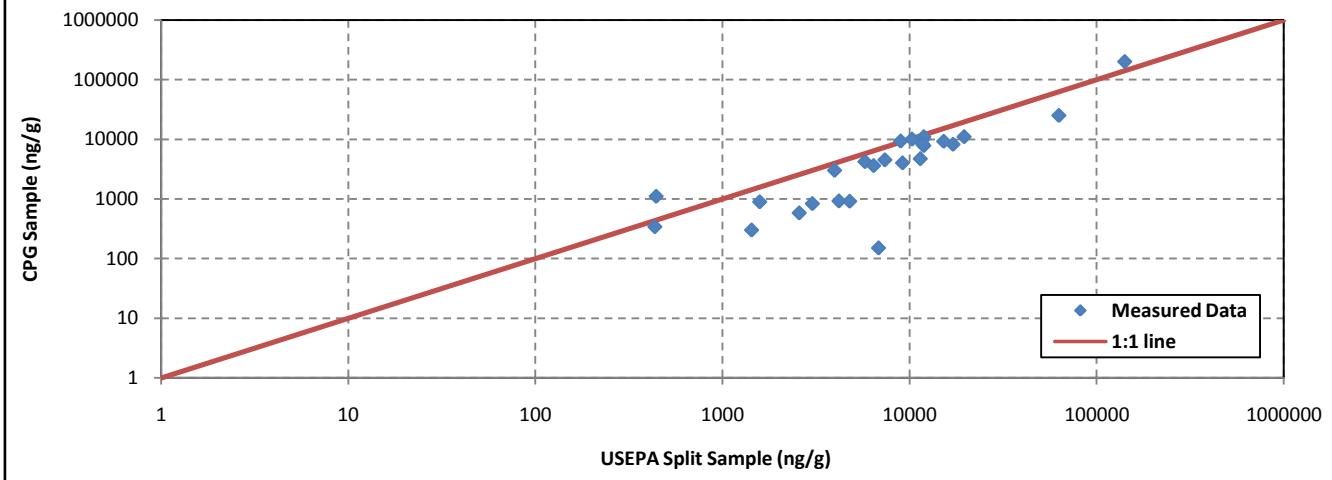
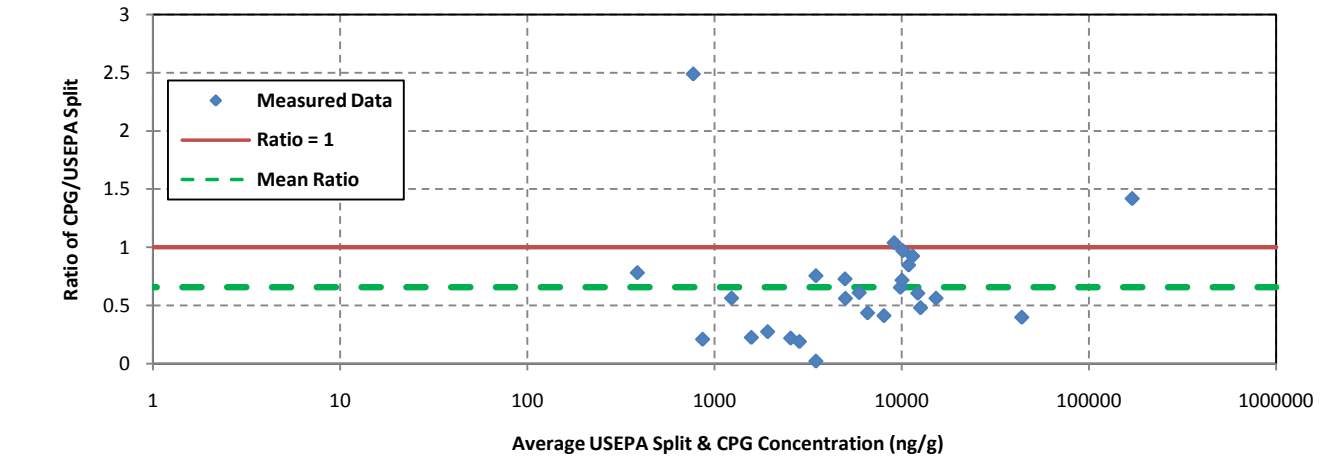


Figure 38c: Bland & Altman Plot of Fluoranthene Ratios and Average Concentrations



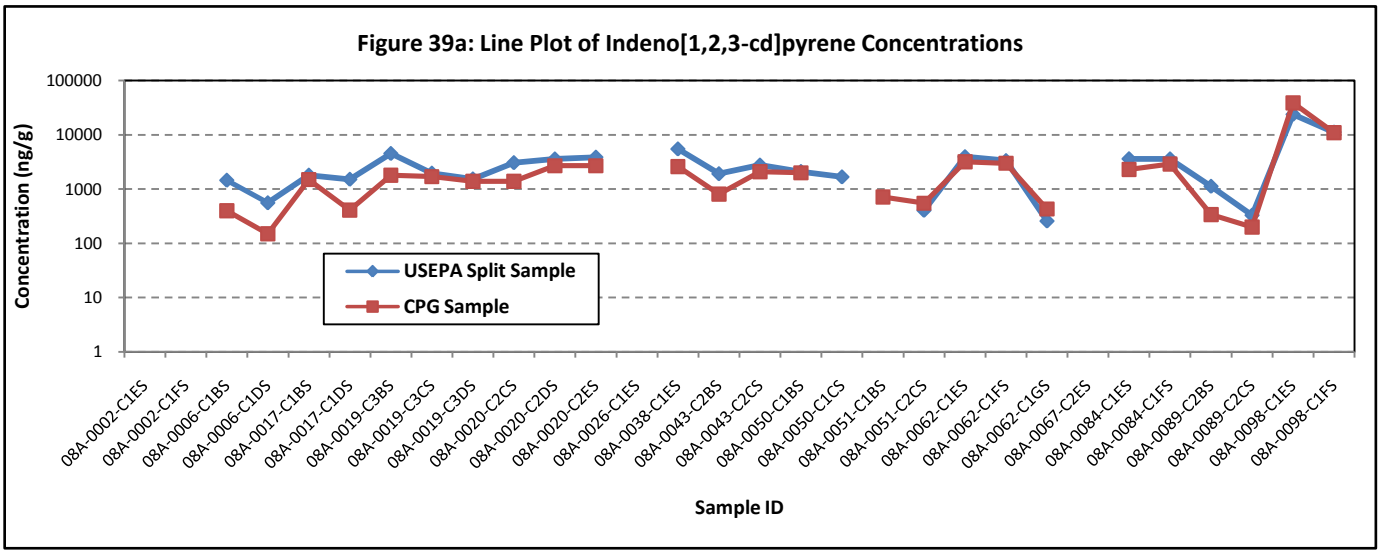


Figure 39a: Line Plot of Indeno[1,2,3-cd]pyrene Concentrations
Concentration (ng/g)
100000
10000
1000
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C1BS
08A-0006-C1DS
08A-0017-C1BS
08A-0017-C1DS
08A-0019-C3BS
08A-0019-C3CS
08A-0019-C3DS
08A-0020-C2CS
08A-0020-C2DS
08A-0020-C2ES
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C2BS
08A-0043-C2CS
08A-0050-C1BS
08A-0050-C1CS
08A-0051-C1BS
08A-0051-C2CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2BS
08A-0089-C2CS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

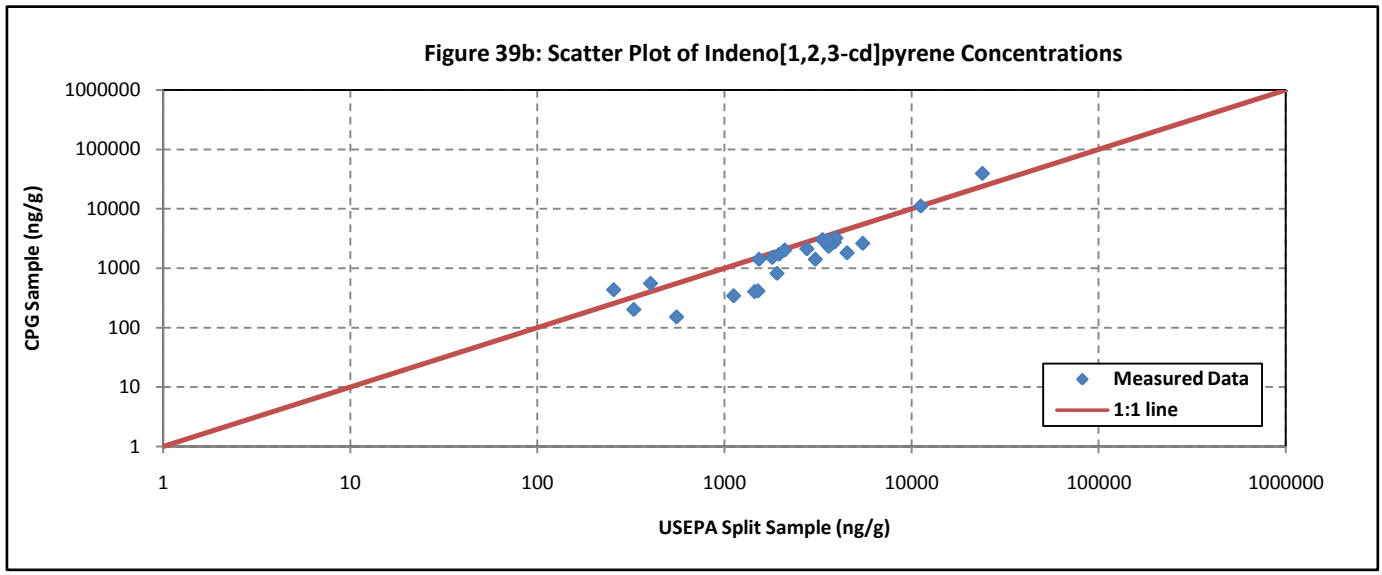


Figure 39b: Scatter Plot of Indeno[1,2,3-cd]pyrene Concentrations
CPG Sample (ng/g)
1000000
100000
10000
1000
100
10
1
Measured Data
1:1 line
1
10
100
1000
10000
100000
1000000
USEPA Split Sample (ng/g)

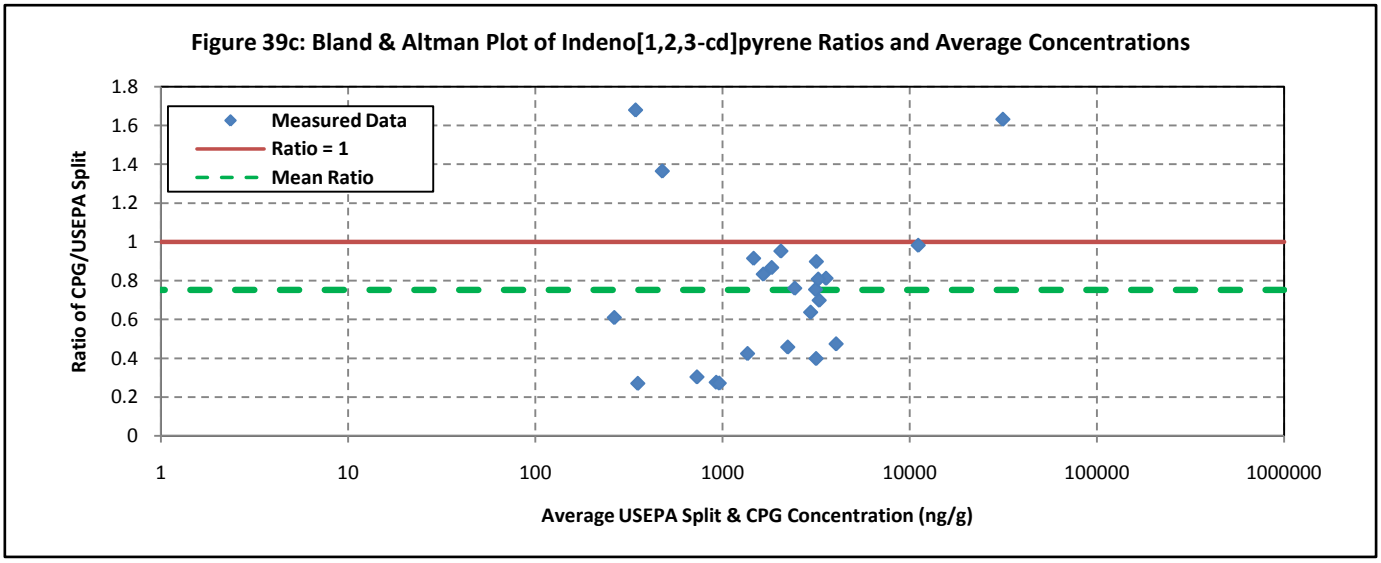


Figure 39c: Bland & Altman Plot of Indeno[1,2,3-cd]pyrene Ratios and Average Concentrations
Ratio of CPG/USEPA Split
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
1000
10000
100000
1000000
Average USEPA Split & CPG Concentration (ng/g)

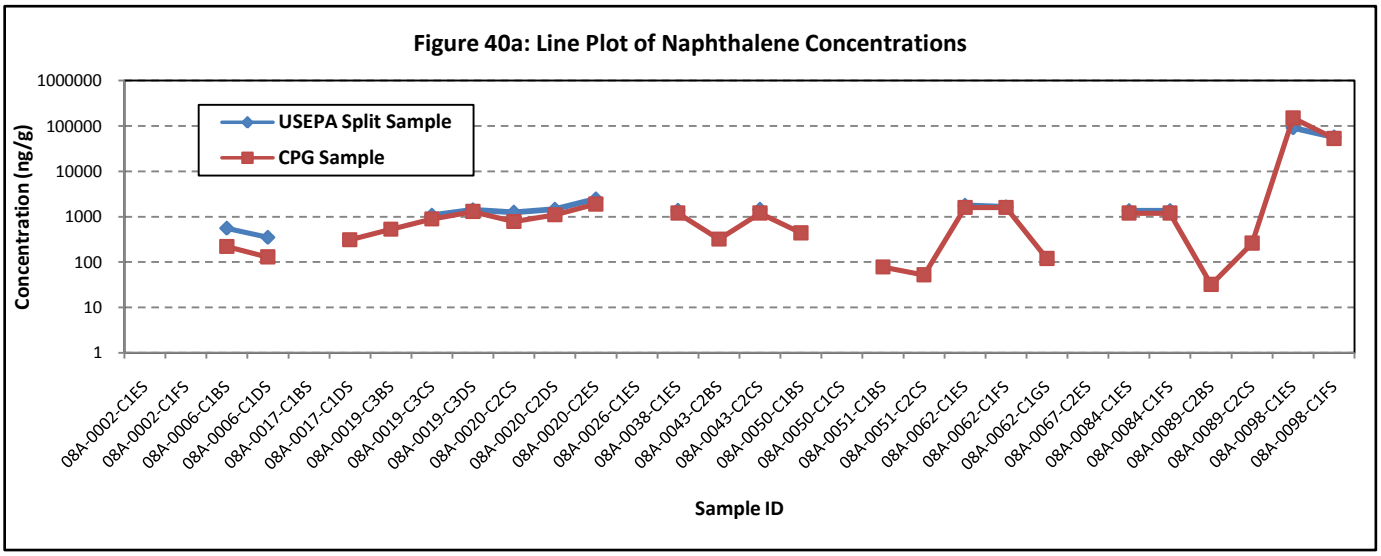


Figure 40a: Line Plot of Naphthalene Concentrations
Concentration (ng/g)
1000000
100000
10000
1000
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C1BS
08A-0006-C1DS
08A-0017-C1BS
08A-0017-C1DS
08A-0019-C3BS
08A-0019-C3CS
08A-0019-C3DS
08A-0020-C2CS
08A-0020-C2DS
08A-0020-C2ES
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C2BS
08A-0043-C2CS
08A-0050-C1BS
08A-0050-C1CS
08A-0051-C1BS
08A-0051-C2CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2BS
08A-0089-C2CS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

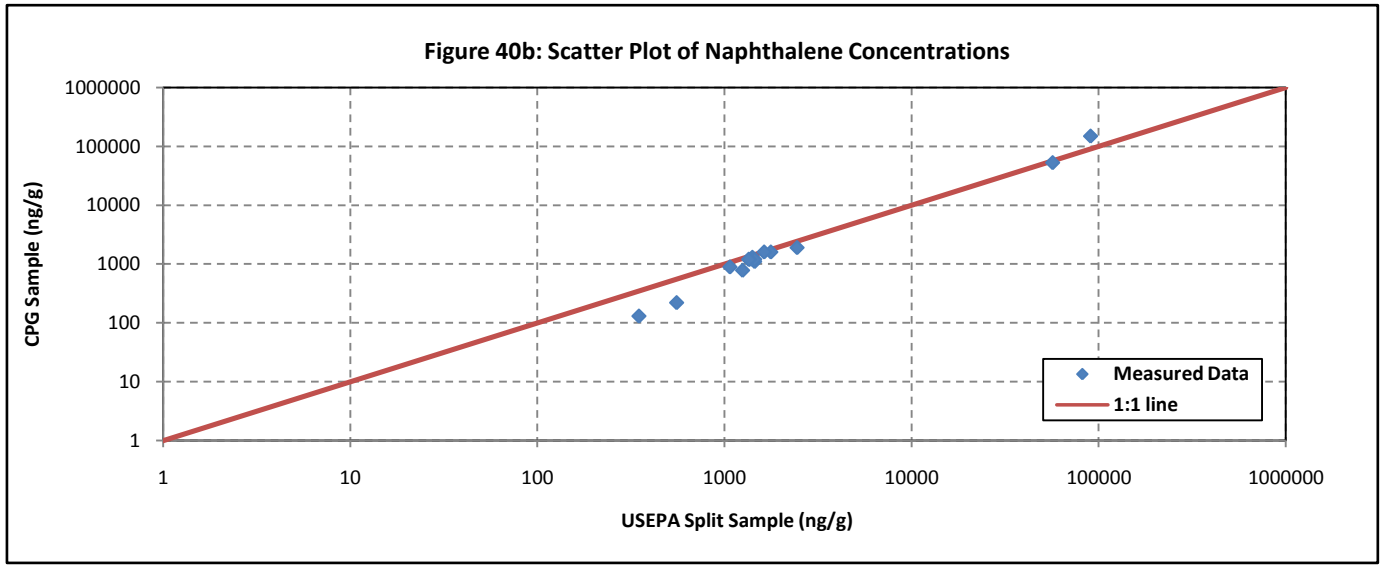


Figure 40b: Scatter Plot of Naphthalene Concentrations
CPG Sample (ng/g)
1000000
100000
10000
1000
100
10
1
Measured Data
1:1 line
1
10
100
1000
10000
100000
1000000
USEPA Split Sample (ng/g)

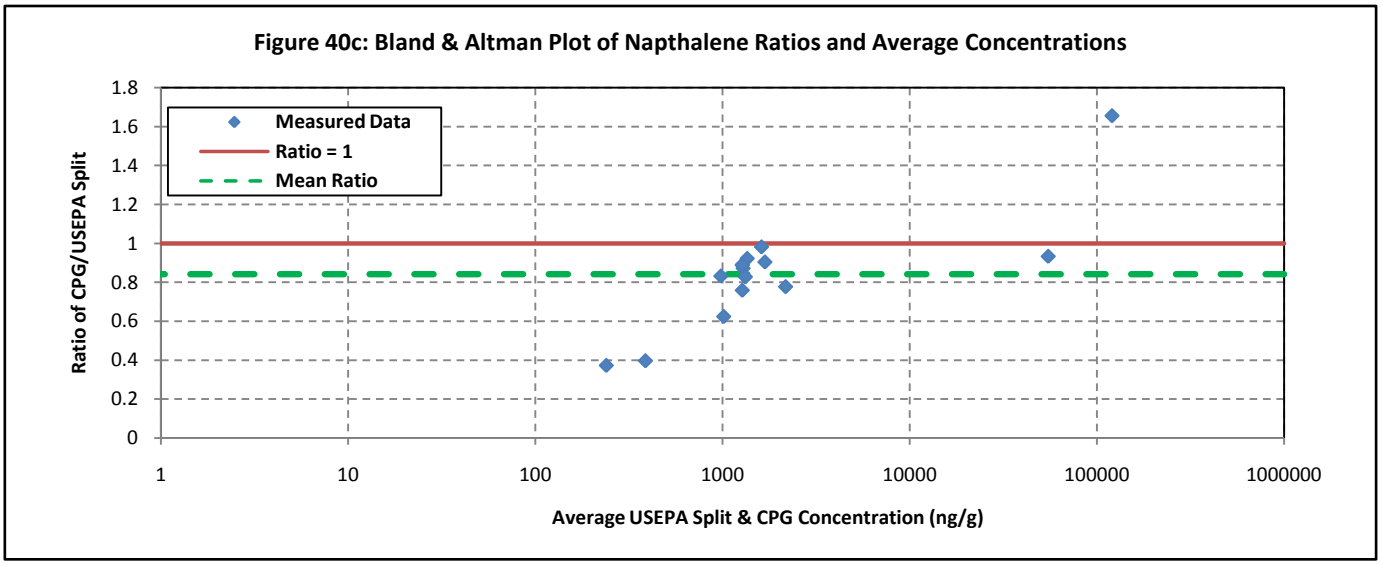


Figure 40c: Bland & Altman Plot of Napthalene Ratios and Average Concentrations
Ratio of CPG/USEPA Split
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
1000
10000
100000
1000000
Average USEPA Split & CPG Concentration (ng/g)

Figure 41a: Line Plot of Phenanthrene Concentrations

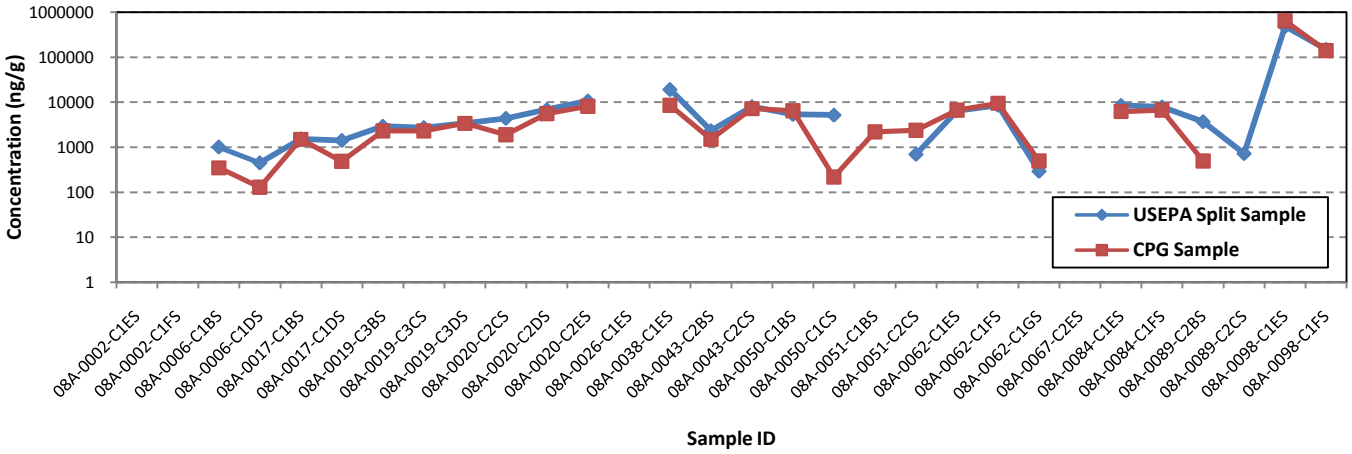


Figure 41b: Scatter Plot of Phenanthrene Concentrations

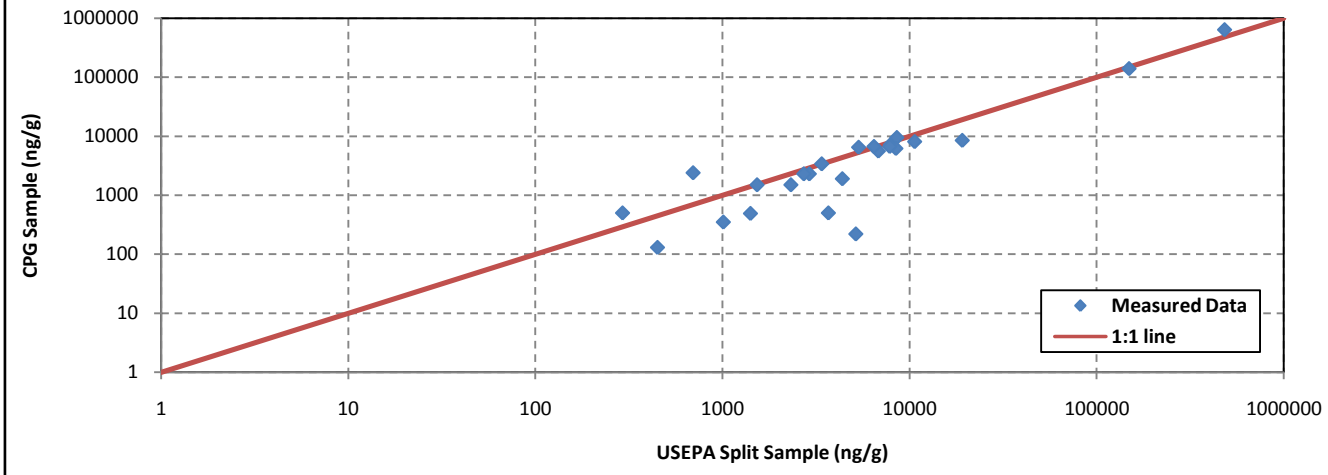
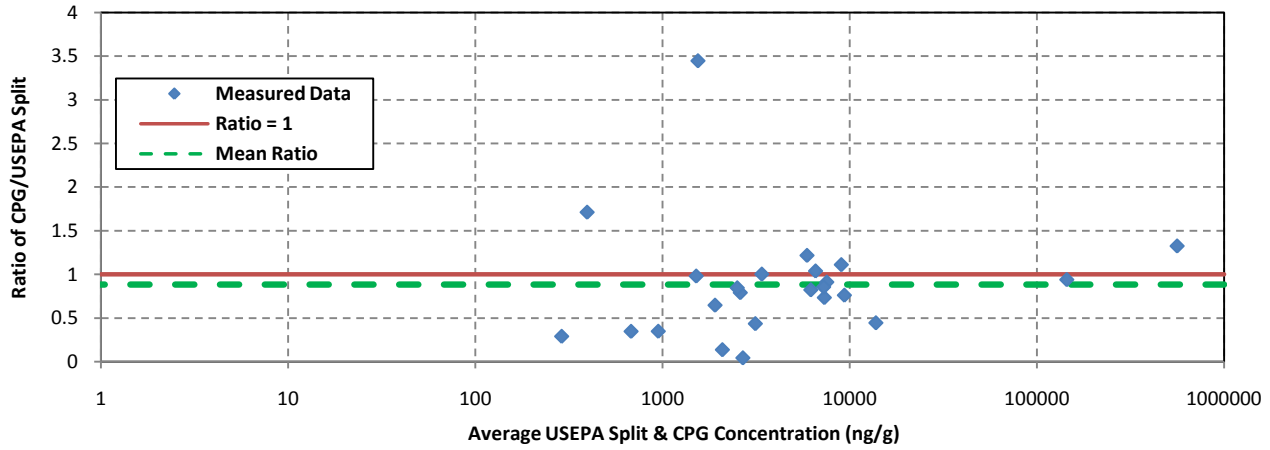


Figure 41c: Bland & Altman Plot of Phenanthrene Ratios and Average Concentrations



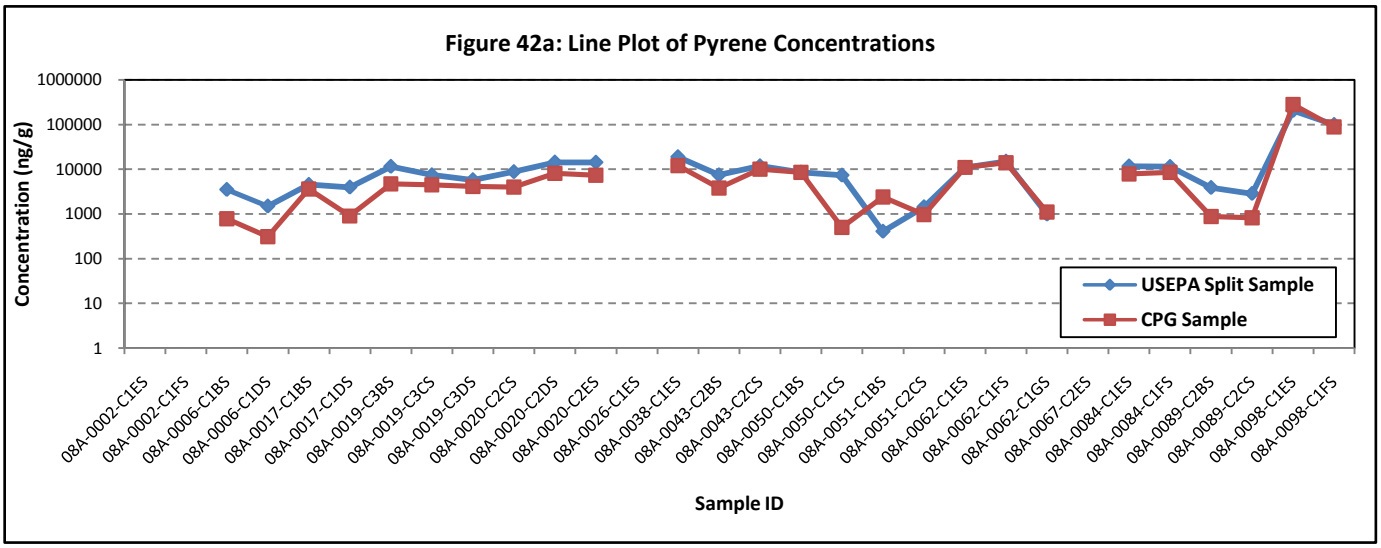


Figure 42a: Line Plot of Pyrene Concentrations
Concentration (ng/g)
1000000
100000
10000
1000
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C1BS
08A-0006-C1DS
08A-0017-C1BS
08A-0017-C1DS
08A-0019-C3BS
08A-0019-C3CS
08A-0019-C3DS
08A-0020-C2CS
08A-0020-C2DS
08A-0020-C2ES
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C2BS
08A-0043-C2CS
08A-0050-C1BS
08A-0050-C1CS
08A-0051-C1BS
08A-0051-C2CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2BS
08A-0089-C2CS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

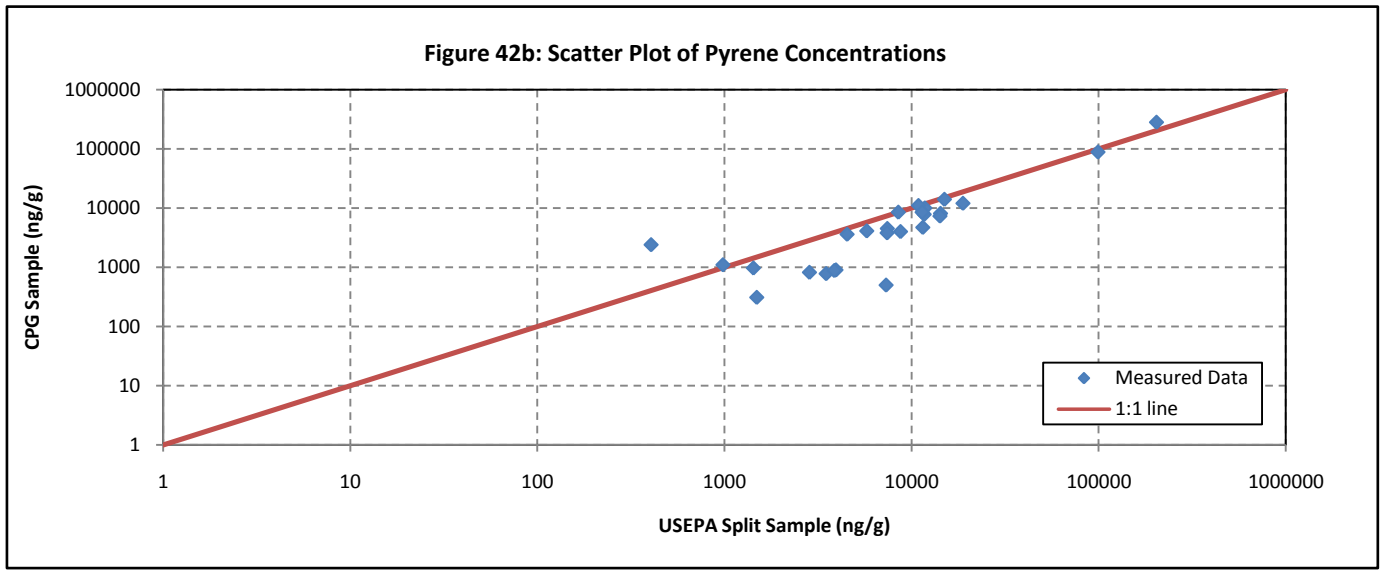


Figure 42b: Scatter Plot of Pyrene Concentrations
CPG Sample (ng/g)
1000000
100000
10000
1000
100
10
1
Measured Data
1:1 line
1
10
100
1000
10000
100000
1000000
USEPA Split Sample (ng/g)

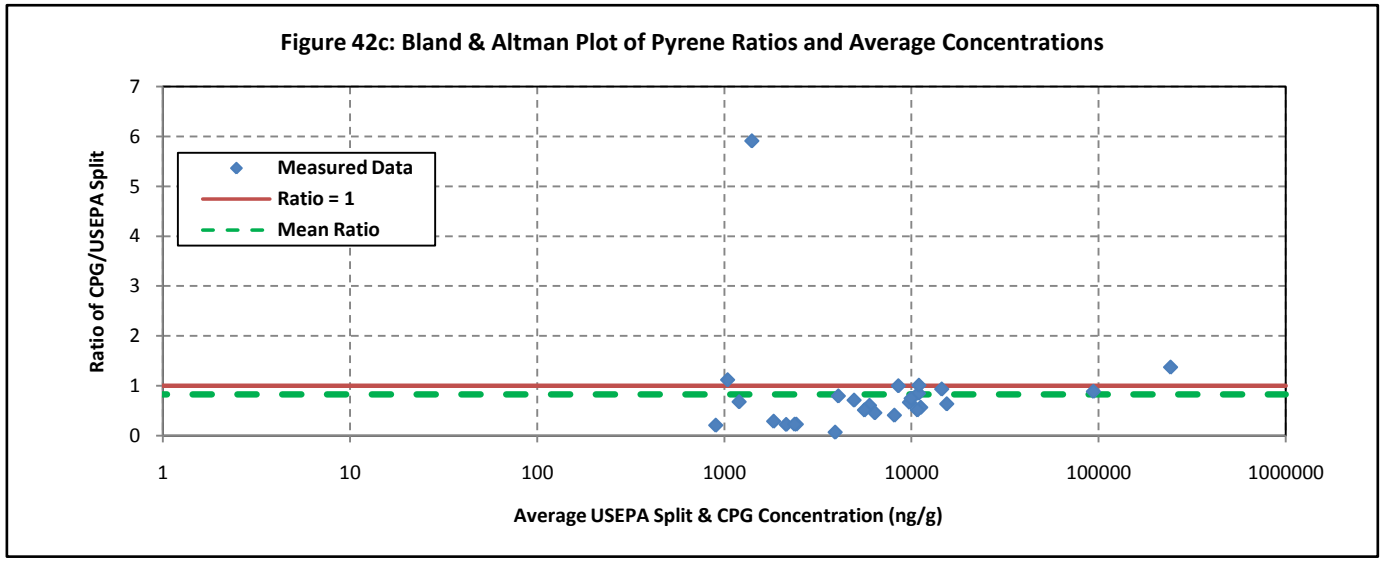


Figure 42c: Bland & Altman Plot of Pyrene Ratios and Average Concentrations
Ratio of CPG/USEPA Split
7
6
5
4
3
2
1
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
1000
10000
100000
1000000
Average USEPA Split & CPG Concentration (ng/g)

Figure 43a: Line Plot of 2,4'-DDD Concentrations

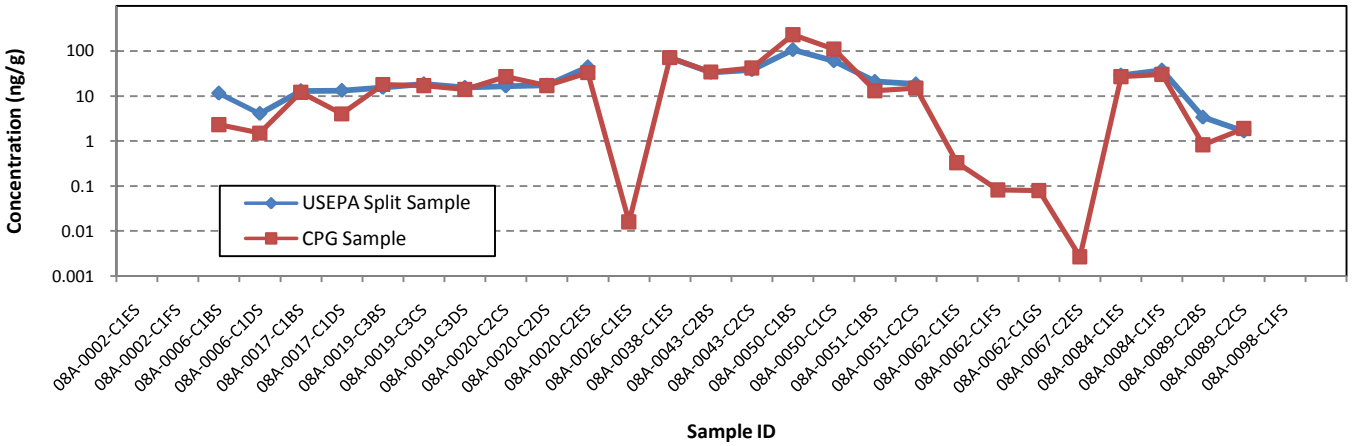


Figure 43b: Scatter Plot of 2,4'-DDD Concentrations

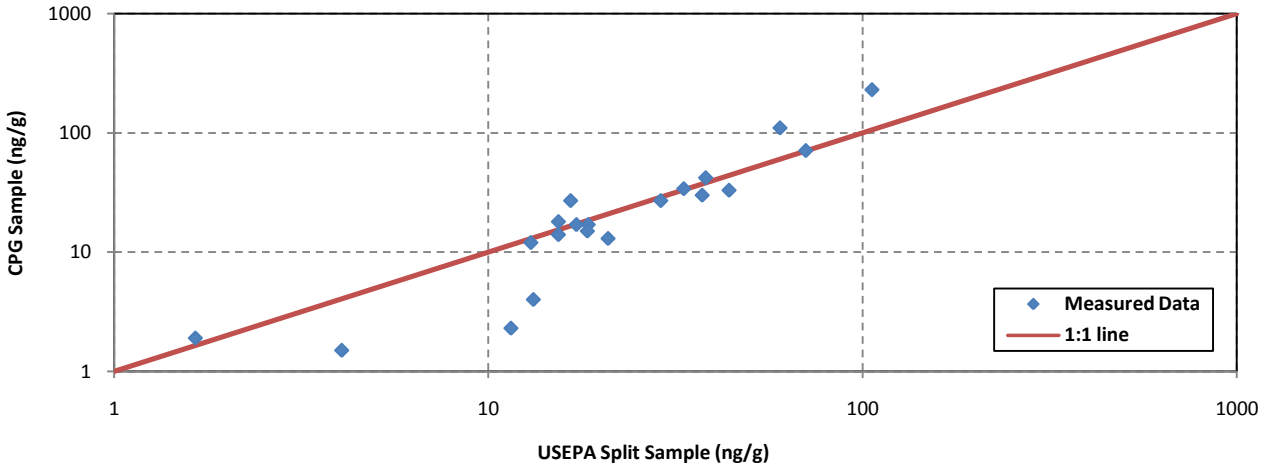


Figure 43c: Bland & Altman Plot of 2,4'-DDD Ratios and Average Concentrations

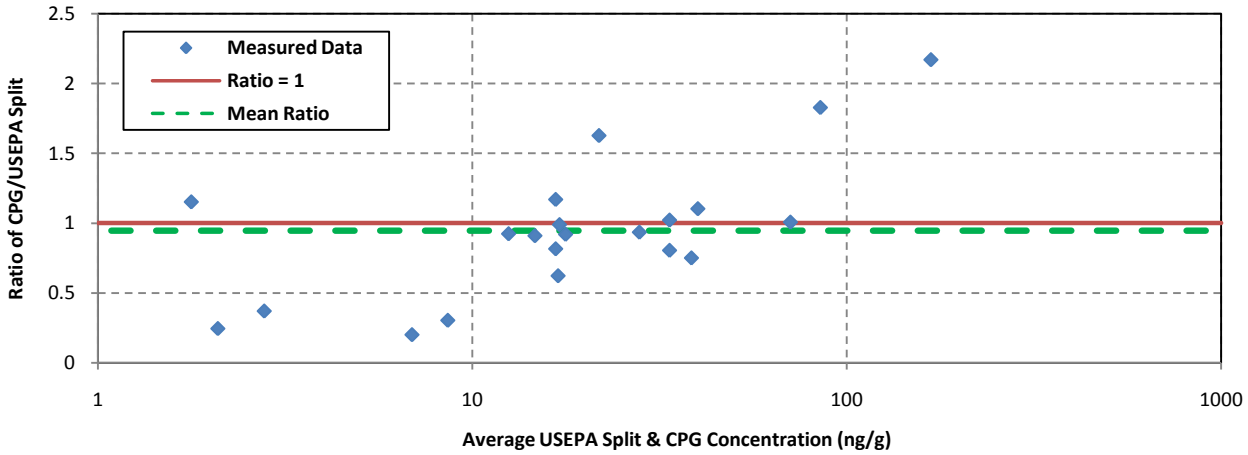


Figure 44a: Line Plot of 2,4'-DDE Concentrations

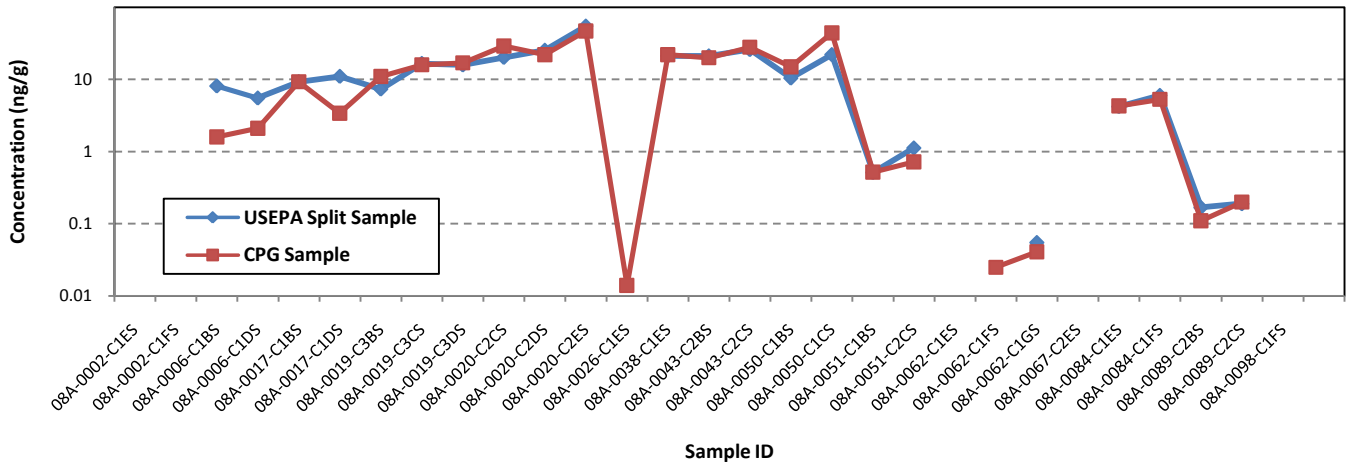


Figure 44b: Scatter Plot of 2,4'-DDE Concentrations

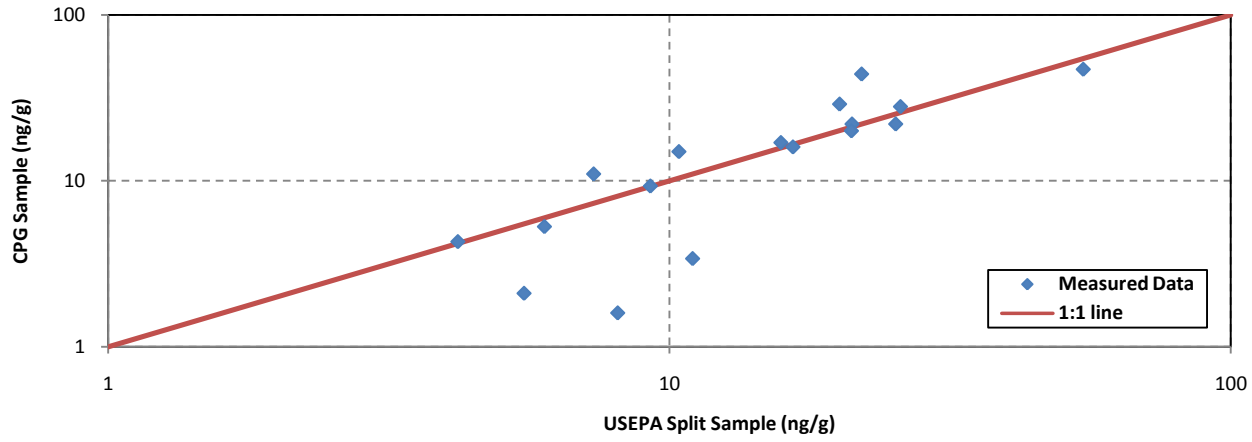
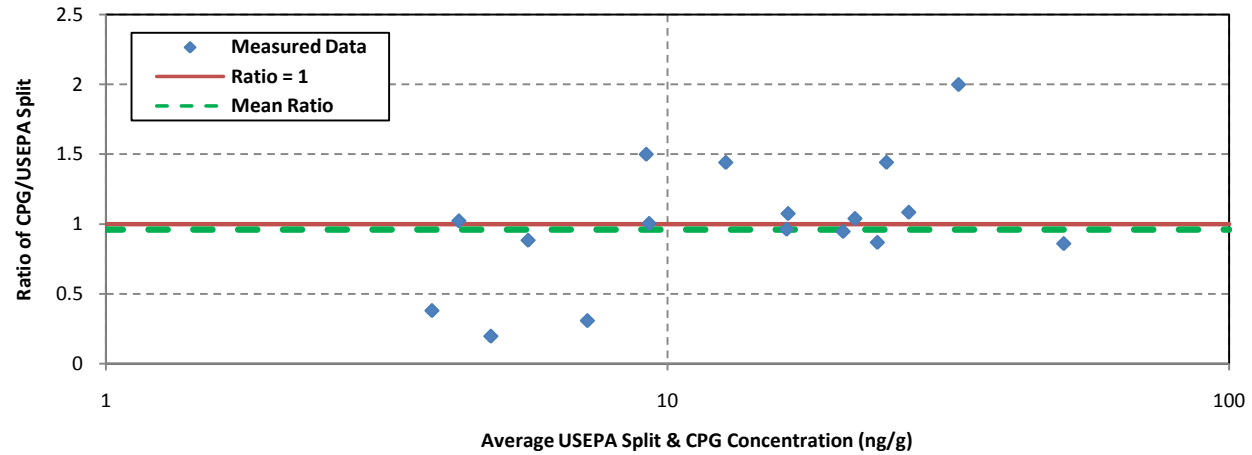


Figure 44c: Bland & Altman Plot of 2,4'-DDE Ratios and Average Concentrations



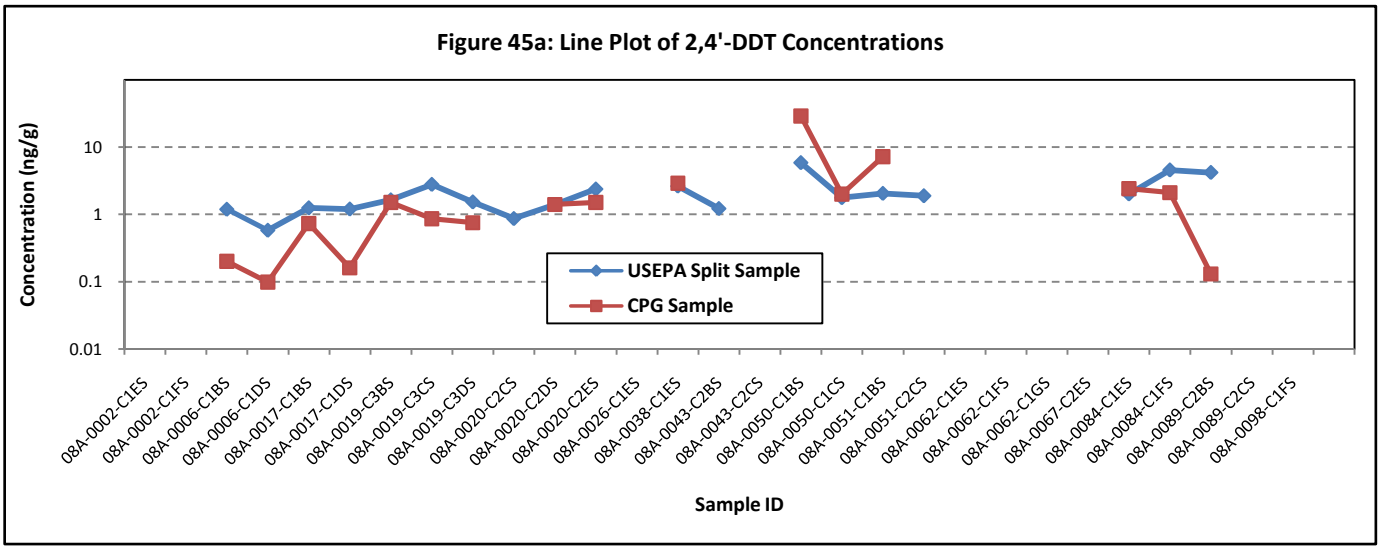


Figure 45a: Line Plot of 2,4'-DDT Concentrations
Concentration (ng/g)
10
1
0.1
0.01
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C1BS
08A-0006-C1DS
08A-0017-C1BS
08A-0017-C1DS
08A-0019-C3BS
08A-0019-C3CS
08A-0019-C3DS
08A-0020-C2CS
08A-0020-C2DS
08A-0020-C2ES
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C2BS
08A-0043-C2CS
08A-0050-C1BS
08A-0050-C1CS
08A-0051-C1BS
08A-0051-C2CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2BS
08A-0089-C2CS
08A-0098-C1FS
Sample ID

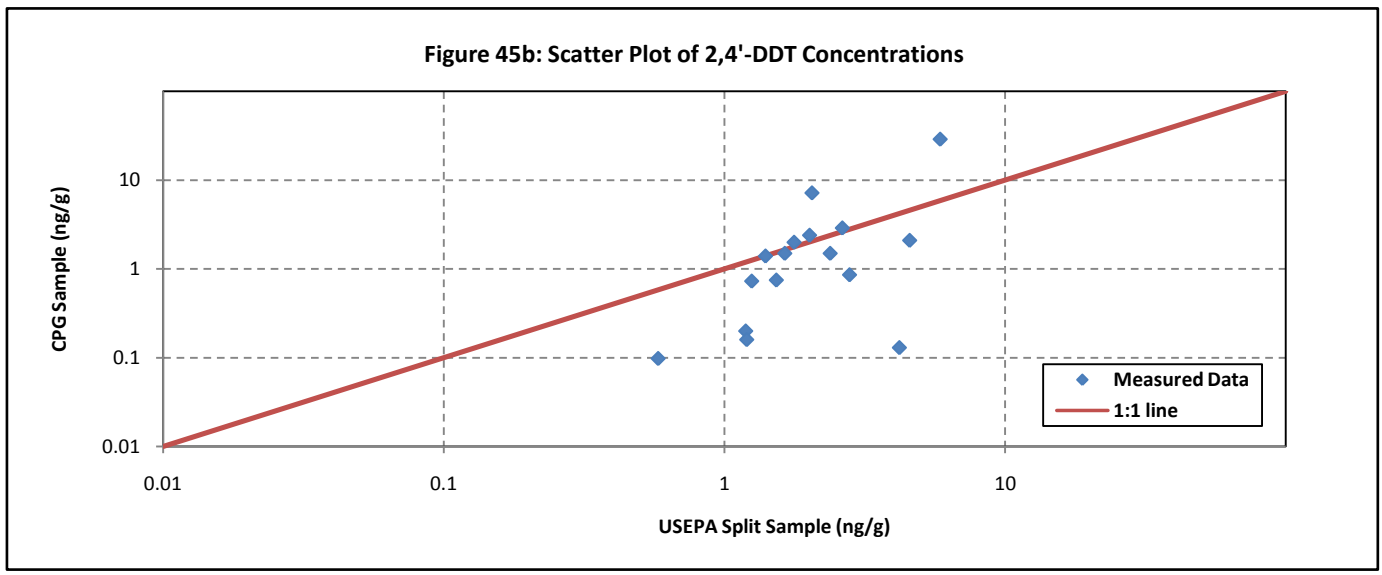


Figure 45b: Scatter Plot of 2,4'-DDT Concentrations
CPG Sample (ng/g)
10
1
0.1
0.01
0.01
0.1
1
10
USEPA Split Sample (ng/g)
Measured Data
1:1 line

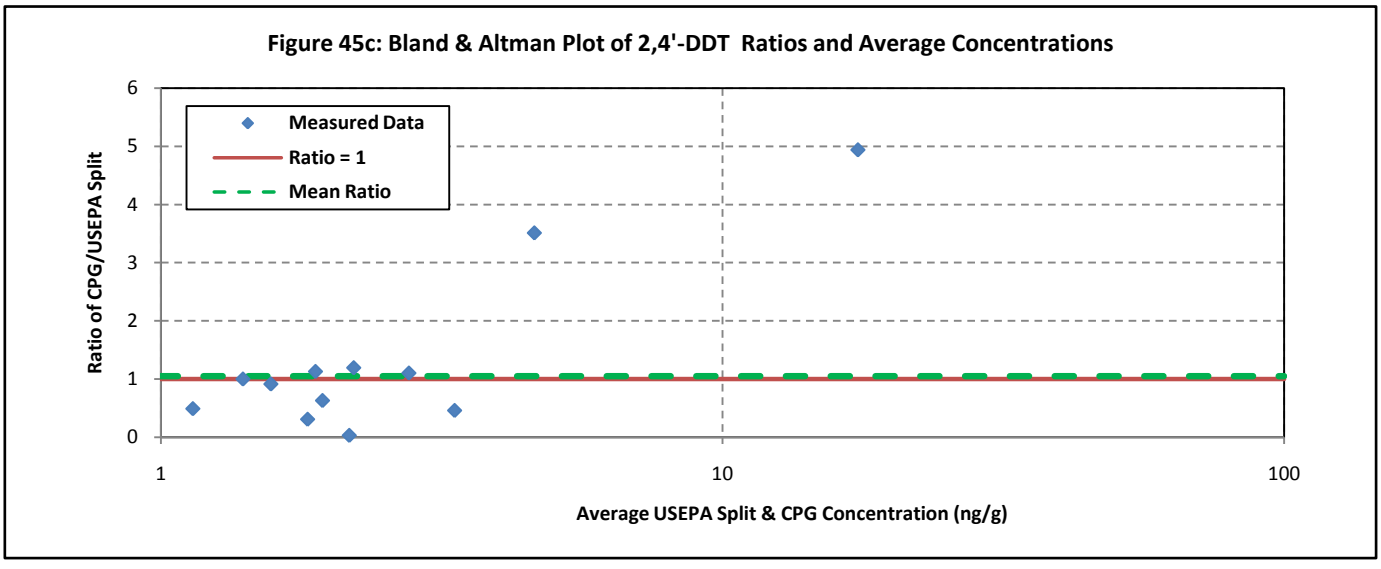


Figure 45c: Bland & Altman Plot of 2,4'-DDT Ratios and Average Concentrations
Ratio of CPG/USEPA Split
6
5
4
3
2
1
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
Average USEPA Split & CPG Concentration (ng/g)

Figure 46a: Line Plot of 4,4'-DDD Concentrations

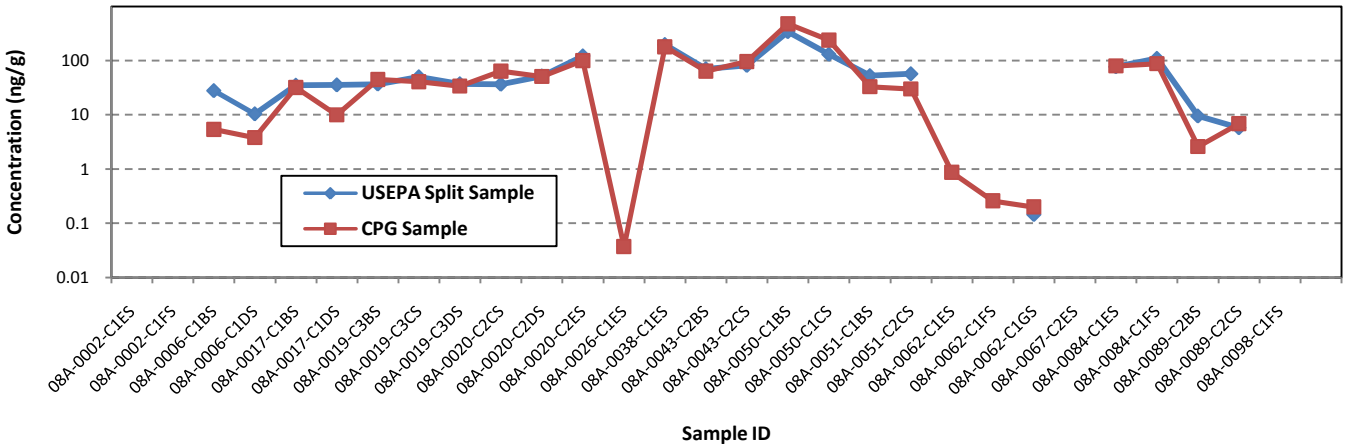


Figure 46b: Scatter Plot of 4,4'-DDD Concentrations

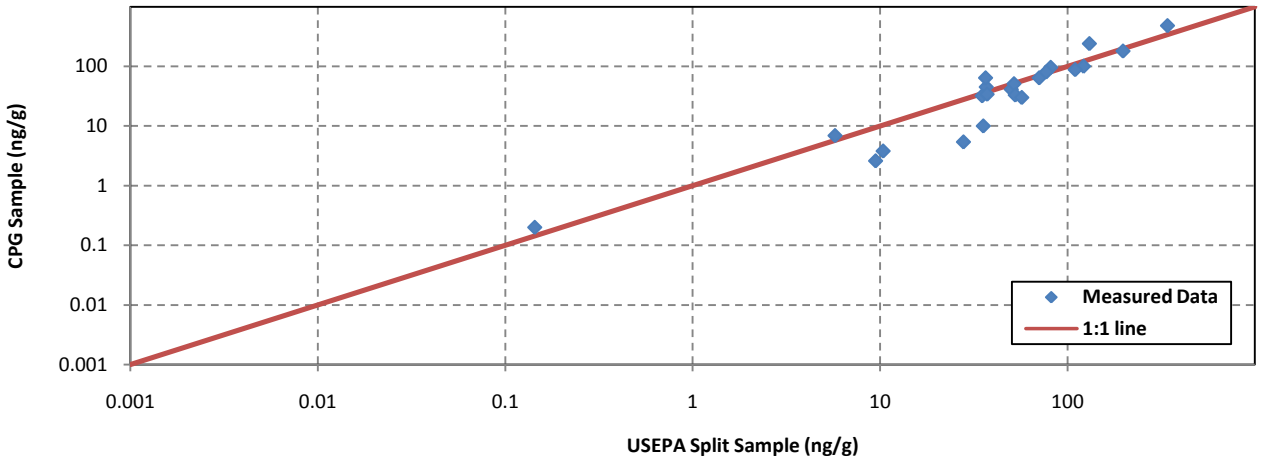


Figure 46c: Bland & Altman Plot of 4,4'-DDD Ratios and Average Concentrations

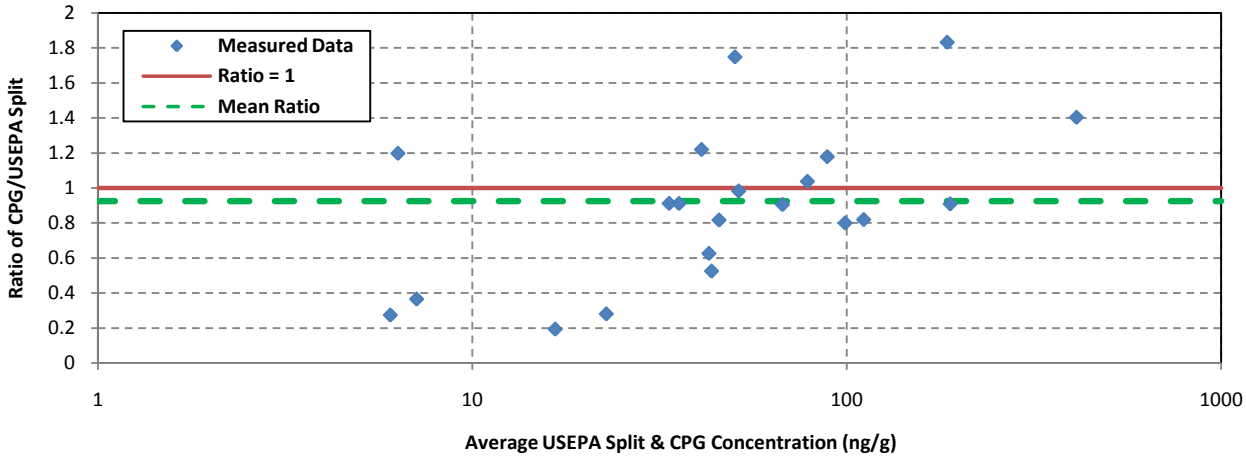


Figure 47a: Line Plot of 4,4'-DDE Concentrations

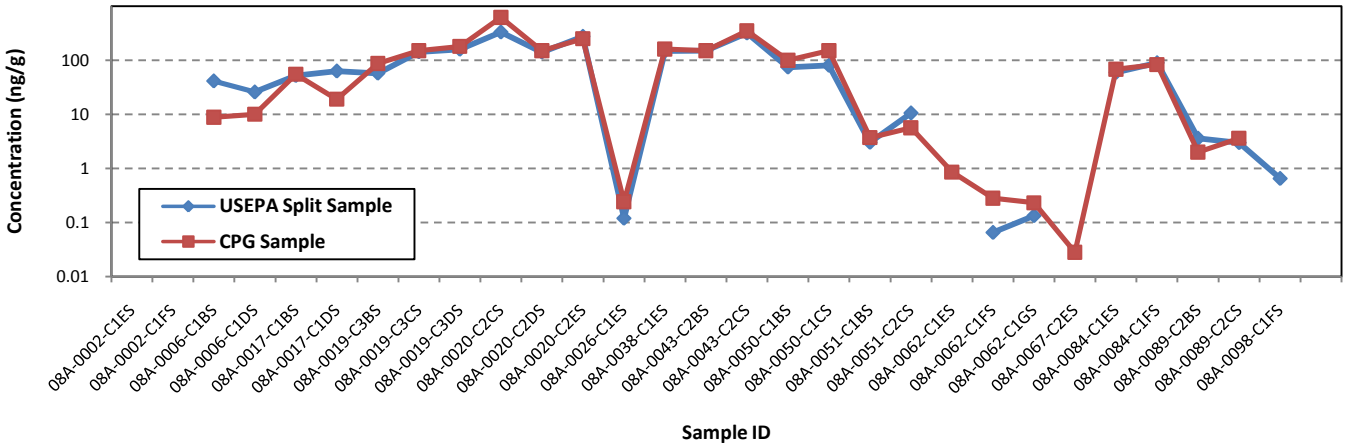


Figure 47b: Scatter Plot of 4,4'-DDE Concentrations

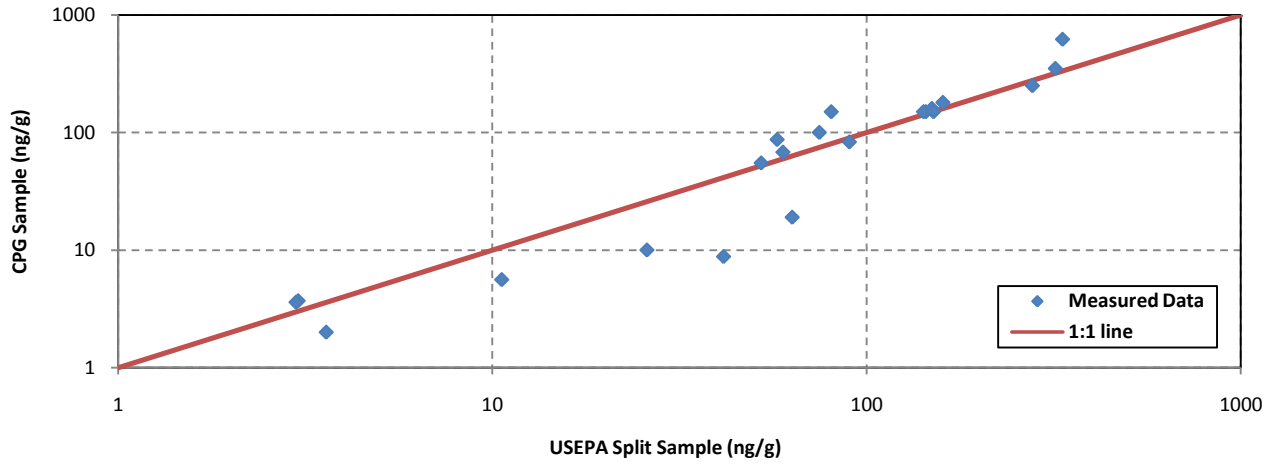
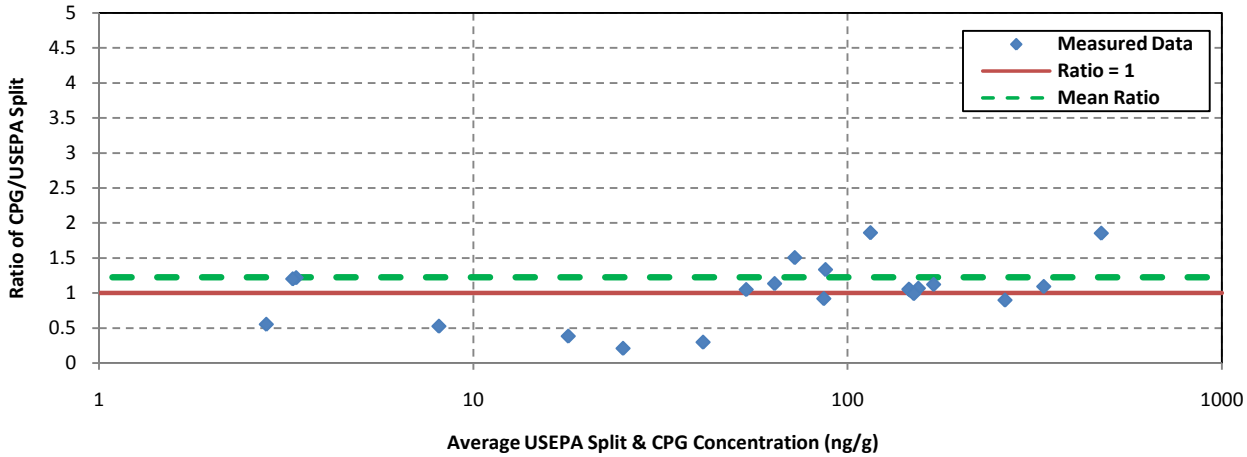


Figure 47c: Bland & Altman Plot of 4,4'-DDE Ratios and Average Concentrations



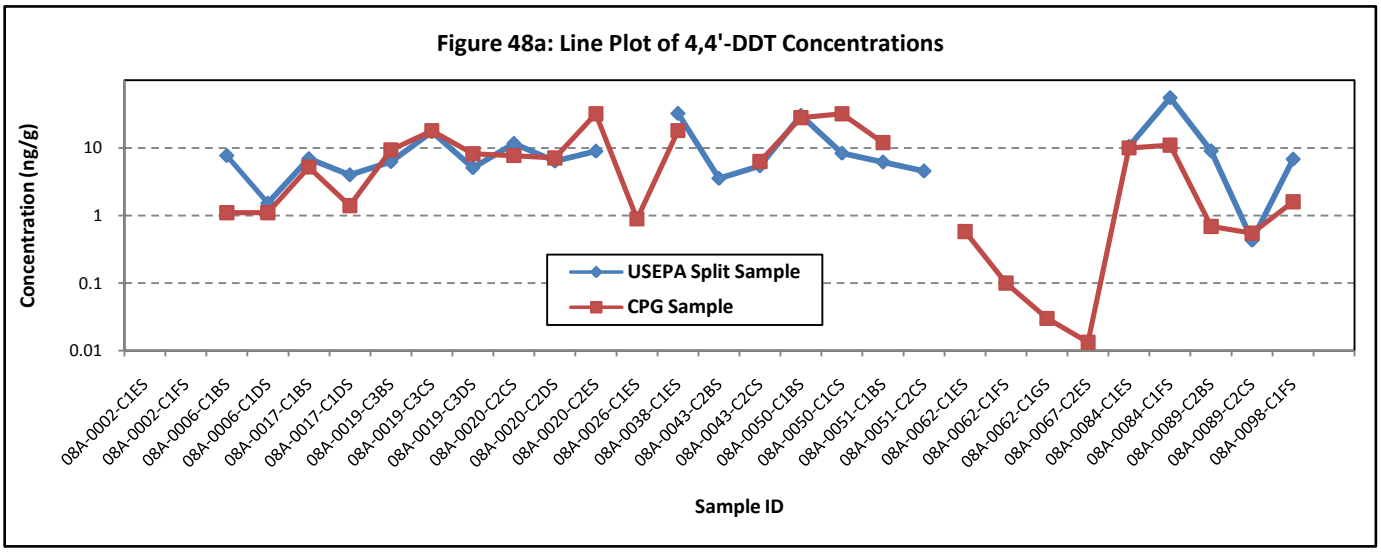


Figure 48a: Line Plot of 4,4'-DDT Concentrations
Concentration (ng/g)
10
1
0.1
0.01
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C1BS
08A-0006-C1DS
08A-0017-C1BS
08A-0017-C1DS
08A-0019-C3BS
08A-0019-C3CS
08A-0019-C3DS
08A-0020-C2CS
08A-0020-C2DS
08A-0020-C2ES
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C2BS
08A-0043-C2CS
08A-0050-C1BS
08A-0050-C1CS
08A-0051-C1BS
08A-0051-C2CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2BS
08A-0089-C2CS
08A-0098-C1FS
Sample ID

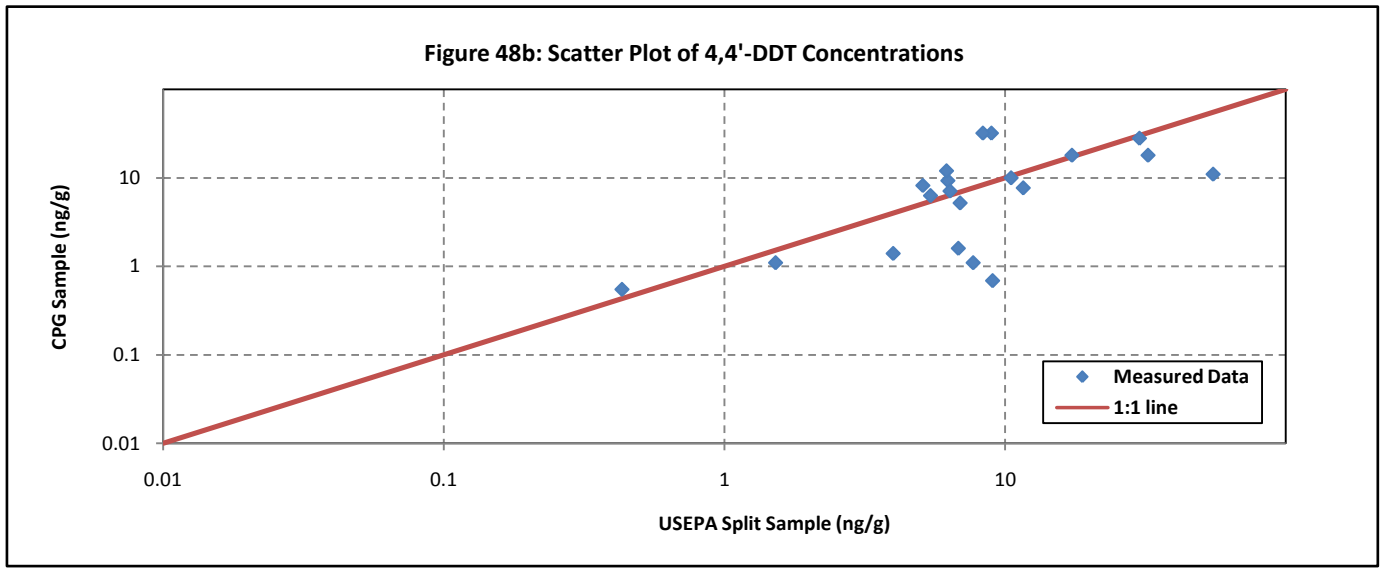


Figure 48b: Scatter Plot of 4,4'-DDT Concentrations
CPG Sample (ng/g)
10
1
0.1
0.01
0.01
0.1
1
10
Measured Data
1:1 line
USEPA Split Sample (ng/g)

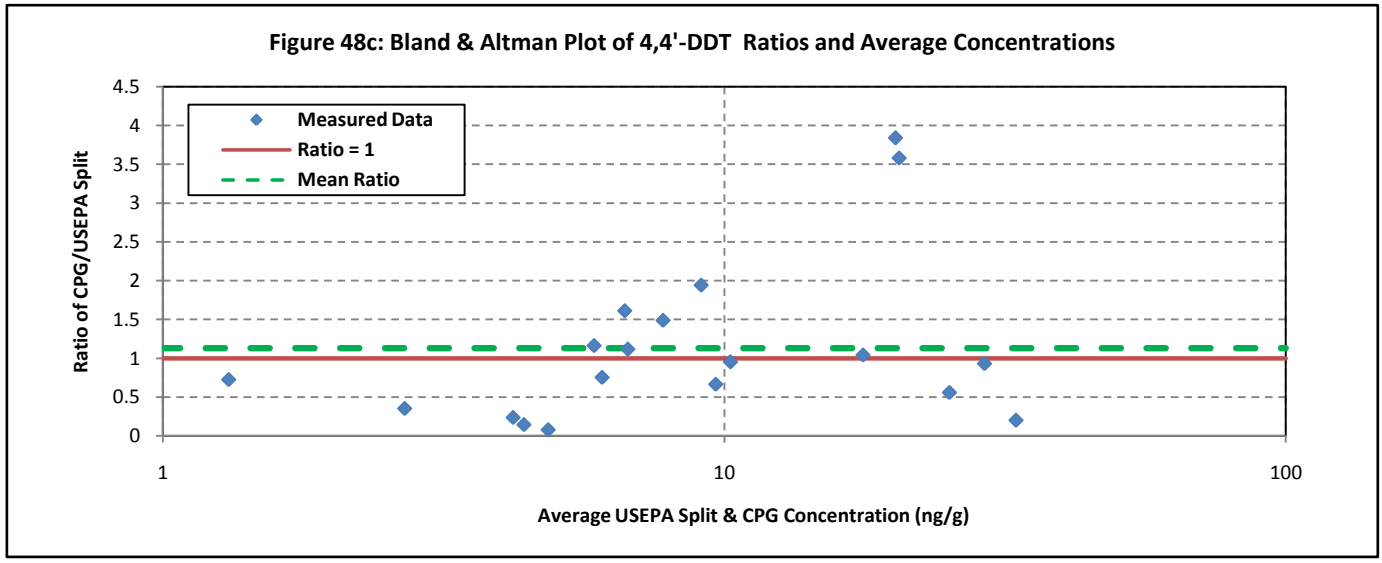
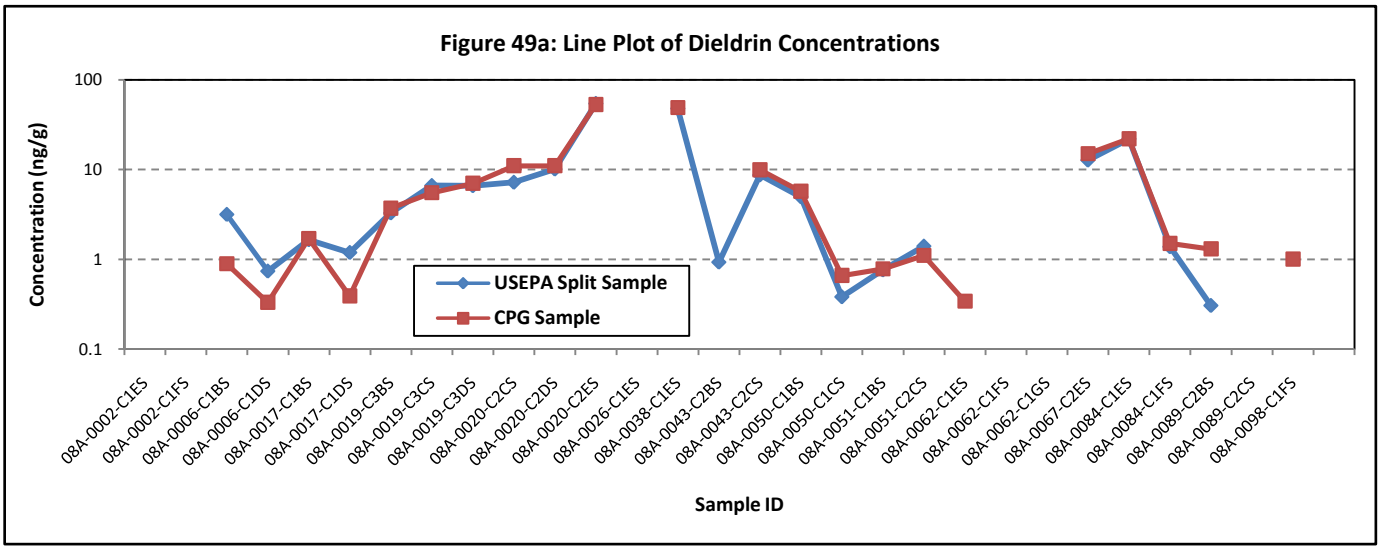
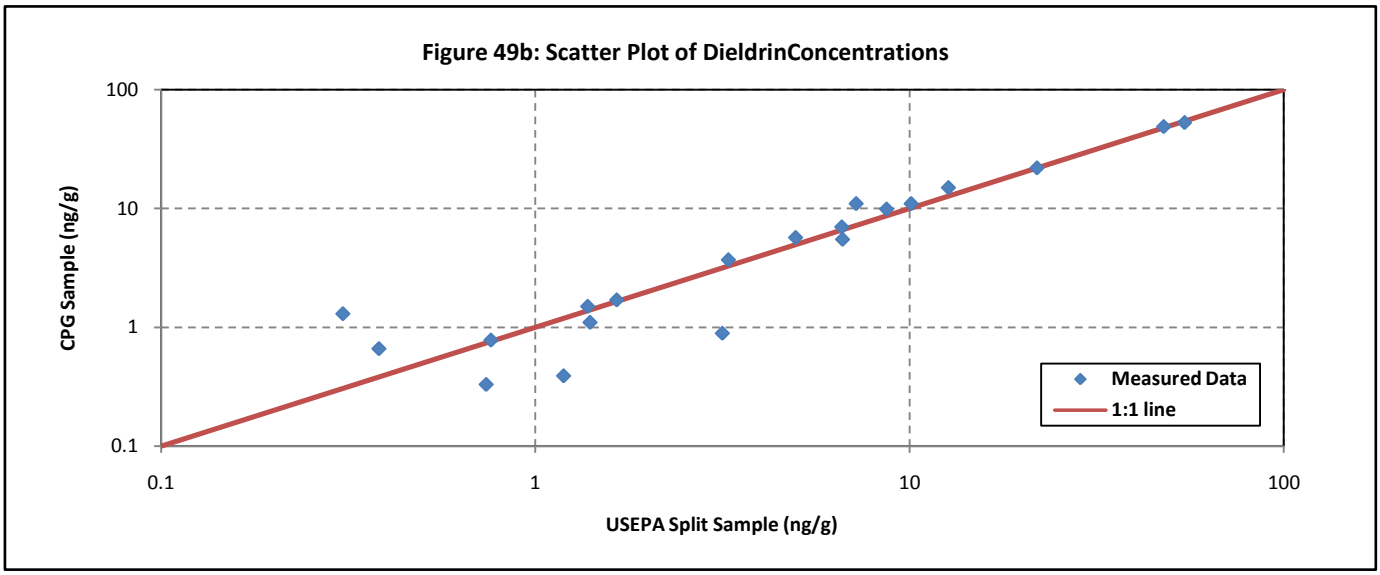
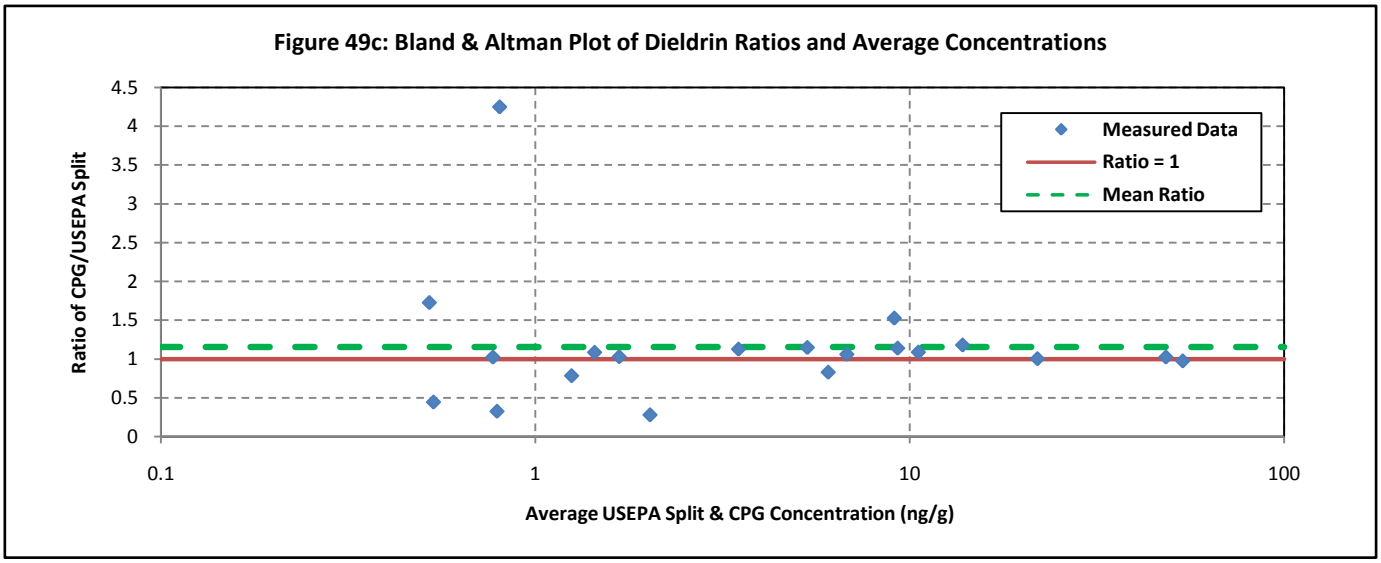


Figure 48c: Bland & Altman Plot of 4,4'-DDT Ratios and Average Concentrations
Ratio of CPG/USEPA Split
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
Average USEPA Split & CPG Concentration (ng/g)







US Army Corps of Engineers®	**Statistical Plots of Dieldrin Concentrations**	**Figure 49**

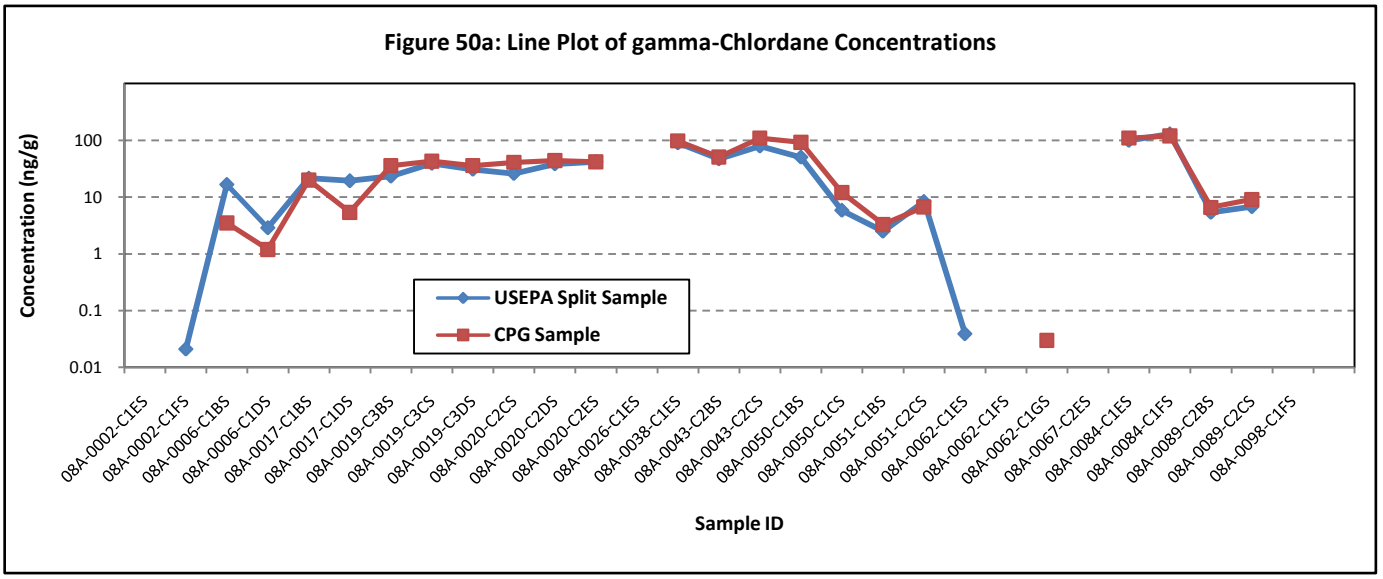


Figure 50a: Line Plot of gamma-Chlordane Concentrations
Concentration (ng/g)
100
10
1
0.1
0.01
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C1BS
08A-0006-C1DS
08A-0017-C1BS
08A-0017-C1DS
08A-0019-C3BS
08A-0019-C3CS
08A-0019-C3DS
08A-0020-C2CS
08A-0020-C2DS
08A-0020-C2ES
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C2BS
08A-0043-C2CS
08A-0050-C1BS
08A-0050-C1CS
08A-0051-C1BS
08A-0051-C2CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2BS
08A-0089-C2CS
08A-0098-C1FS
Sample ID

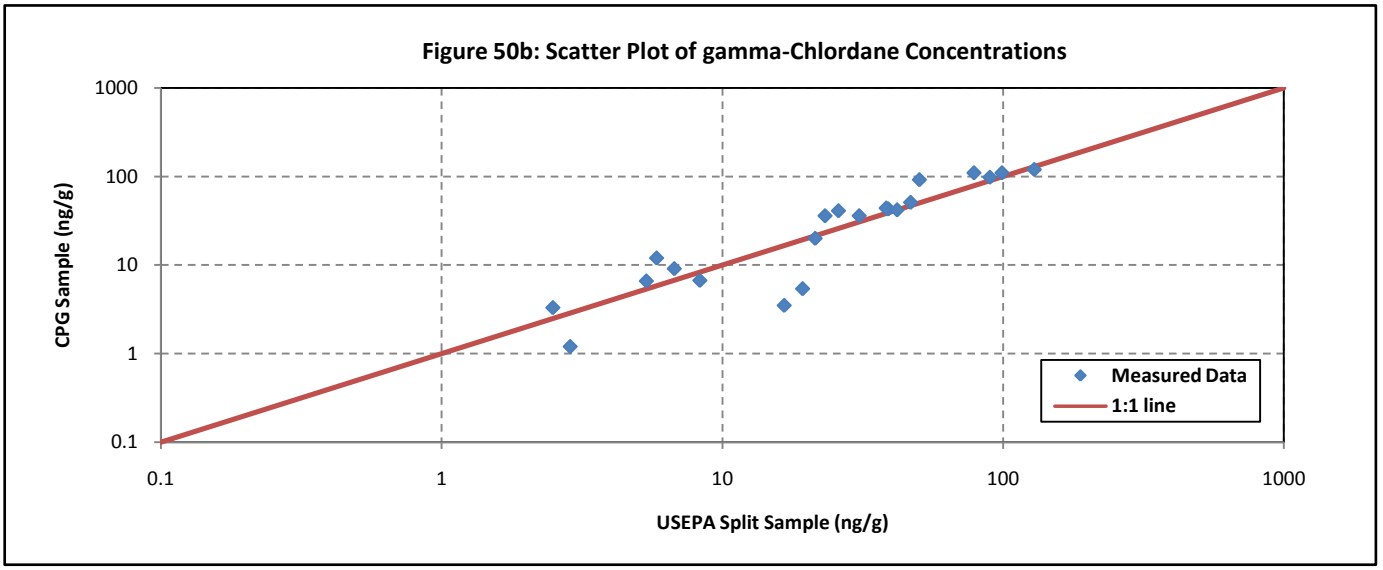


Figure 50b: Scatter Plot of gamma-Chlordane Concentrations
CPG Sample (ng/g)
1000
100
10
1
0.1
Measured Data
1:1 line
0.1
1
10
100
1000
USEPA Split Sample (ng/g)

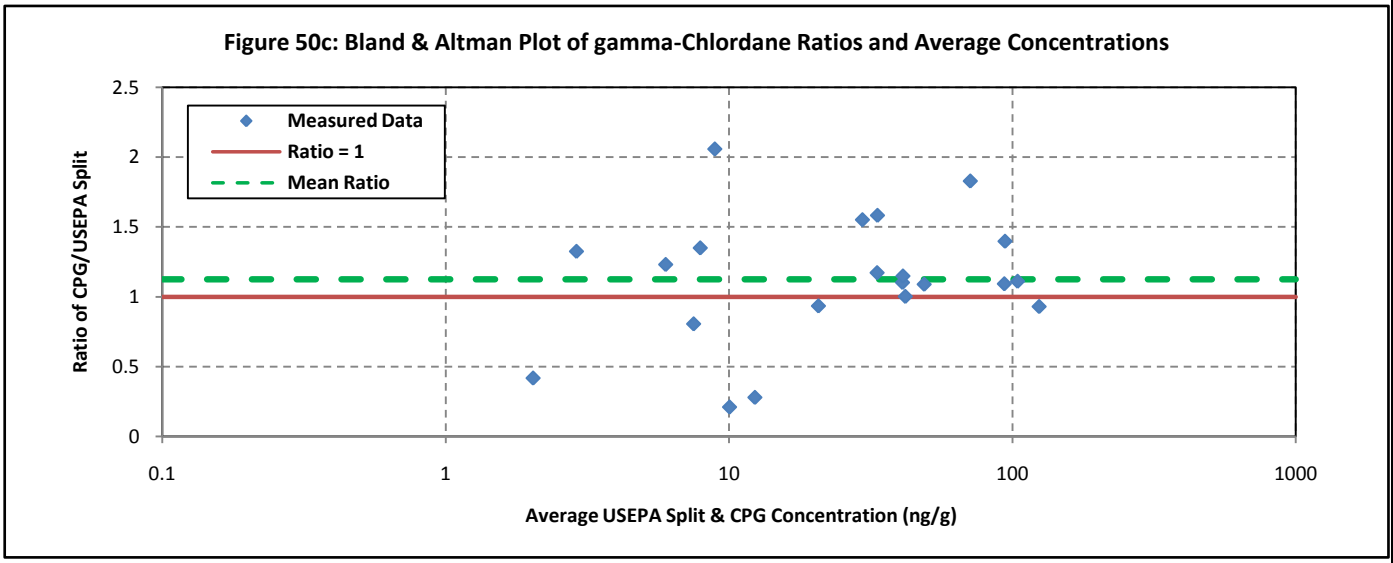


Figure 50c: Bland & Altman Plot of gamma-Chlordane Ratios and Average Concentrations
Ratio of CPG/USEPA Split
2.5
2
1.5
1
0.5
0
Measured Data
Ratio = 1
Mean Ratio
0.1
1
10
100
1000
Average USEPA Split & CPG Concentration (ng/g)

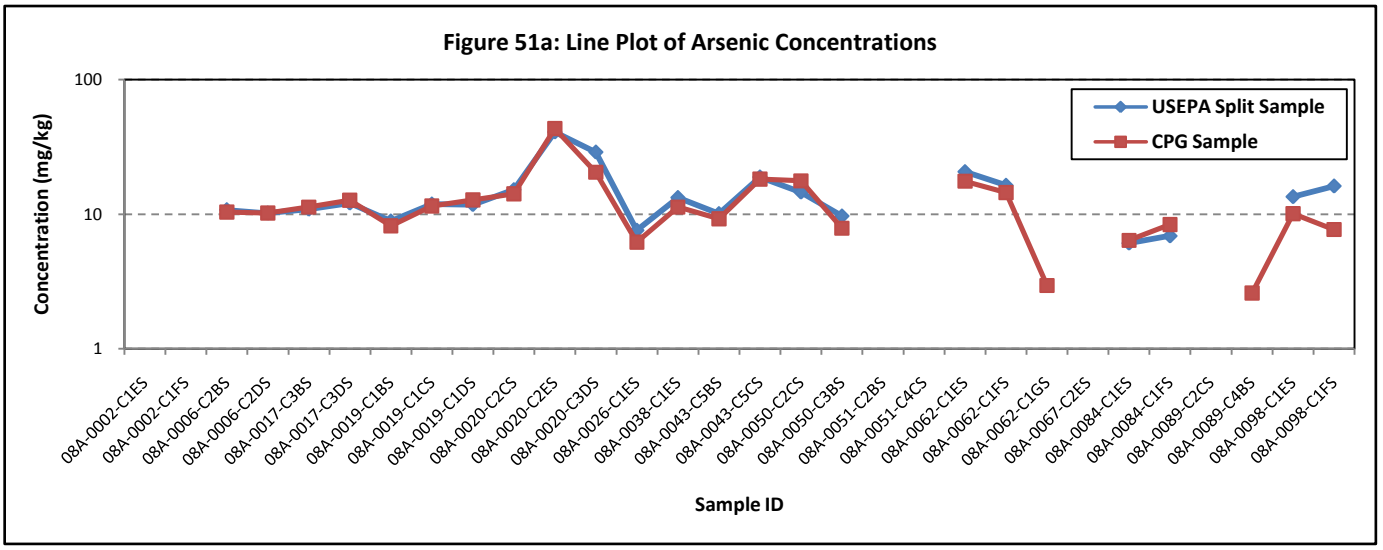


Figure 51a: Line Plot of Arsenic Concentrations
Concentration (mg/kg)
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C2BS
08A-0006-C2DS
08A-0017-C3BS
08A-0017-C3DS
08A-0019-C1BS
08A-0019-C1CS
08A-0019-C1DS
08A-0020-C2CS
08A-0020-C2ES
08A-0020-C3DS
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C5BS
08A-0043-C5CS
08A-0050-C2CS
08A-0050-C3BS
08A-0051-C2BS
08A-0051-C4CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2CS
08A-0089-C4BS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

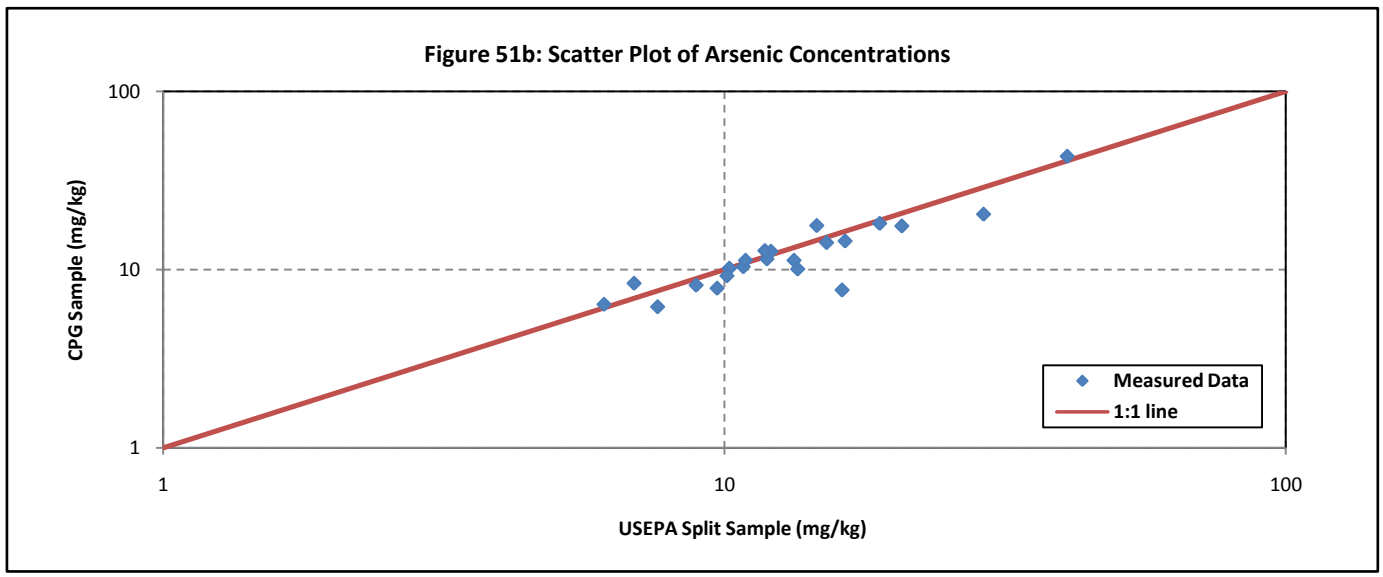


Figure 51b: Scatter Plot of Arsenic Concentrations
CPG Sample (mg/kg)
100
10
1
Measured Data
1:1 line
1
10
100
USEPA Split Sample (mg/kg)

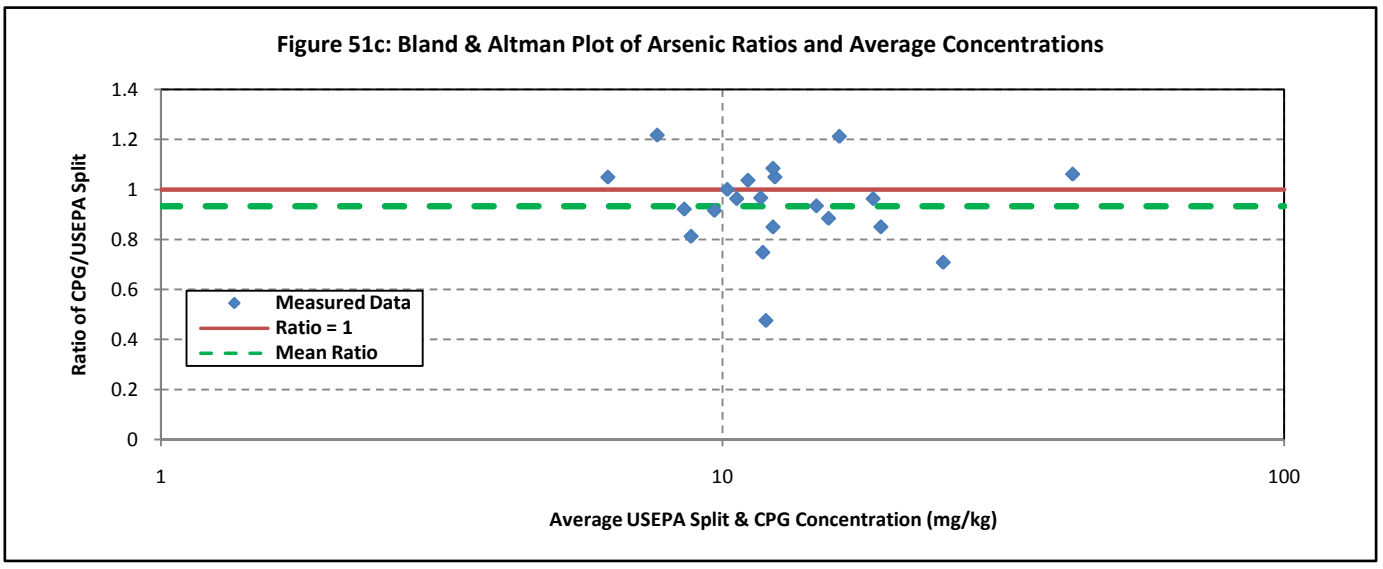


Figure 51c: Bland & Altman Plot of Arsenic Ratios and Average Concentrations
Ratio of CPG/USEPA Split
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
Average USEPA Split & CPG Concentration (mg/kg)

Figure 52a: Line Plot of Barium Concentrations

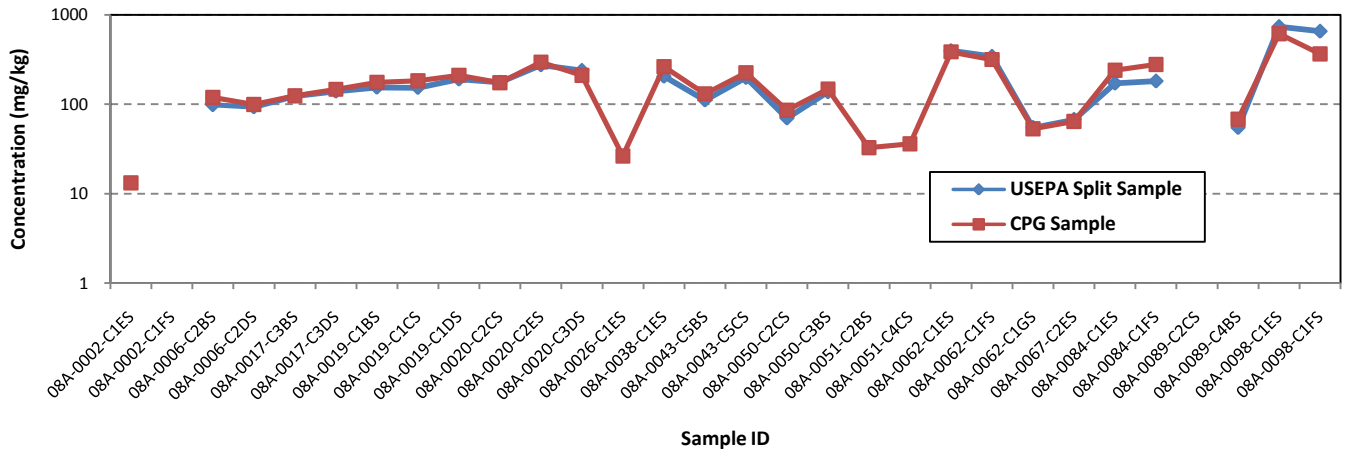


Figure 52b: Scatter Plot of Barium Concentrations

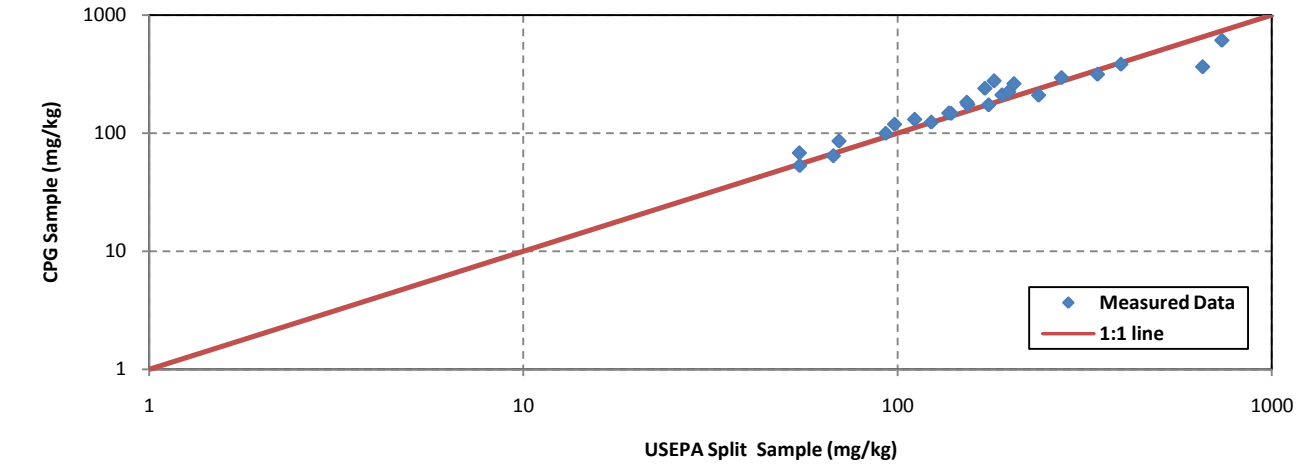
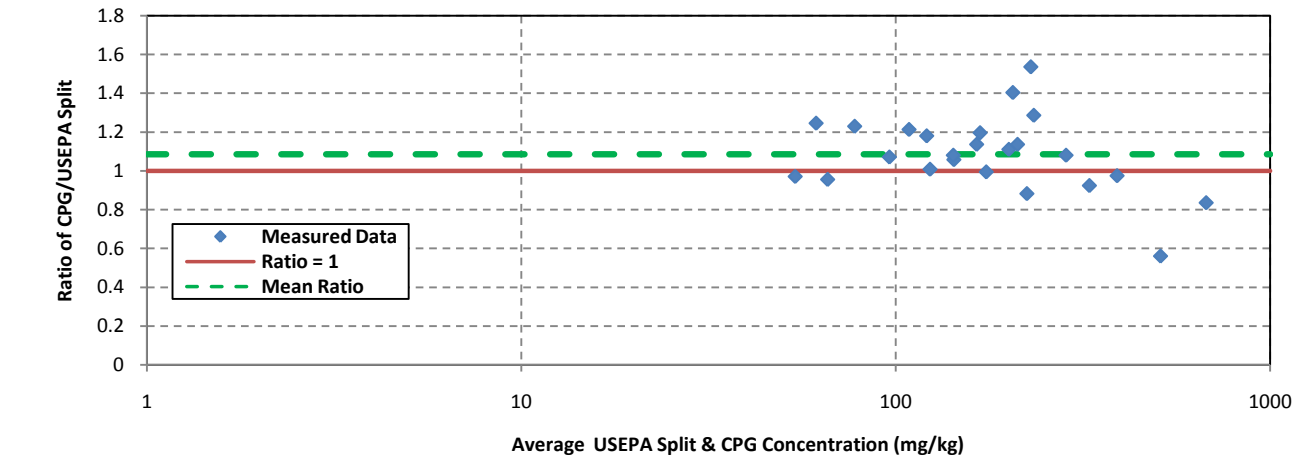


Figure 52c: Bland & Altman Plot of Barium Ratios and Average Concentrations



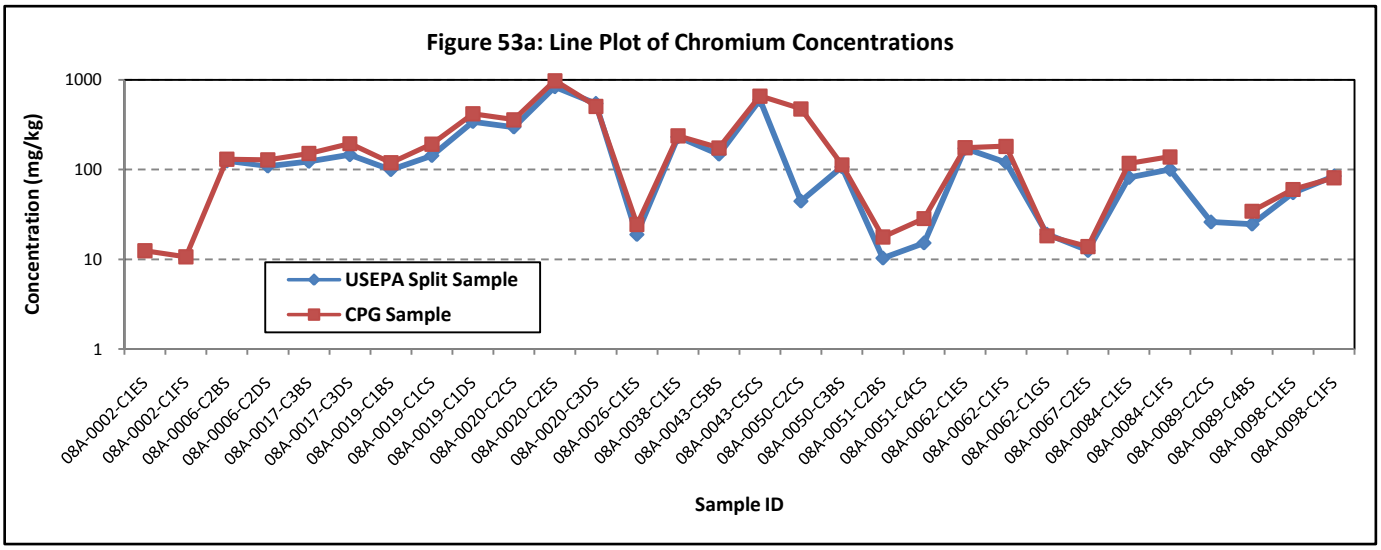


Figure 53a: Line Plot of Chromium Concentrations
Concentration (mg/kg)
1000
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C2BS
08A-0006-C2DS
08A-0017-C3BS
08A-0017-C3DS
08A-0019-C1BS
08A-0019-C1CS
08A-0019-C1DS
08A-0020-C2CS
08A-0020-C2ES
08A-0020-C3DS
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C5BS
08A-0043-C5CS
08A-0050-C2CS
08A-0050-C3BS
08A-0051-C2BS
08A-0051-C4CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2CS
08A-0089-C4BS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

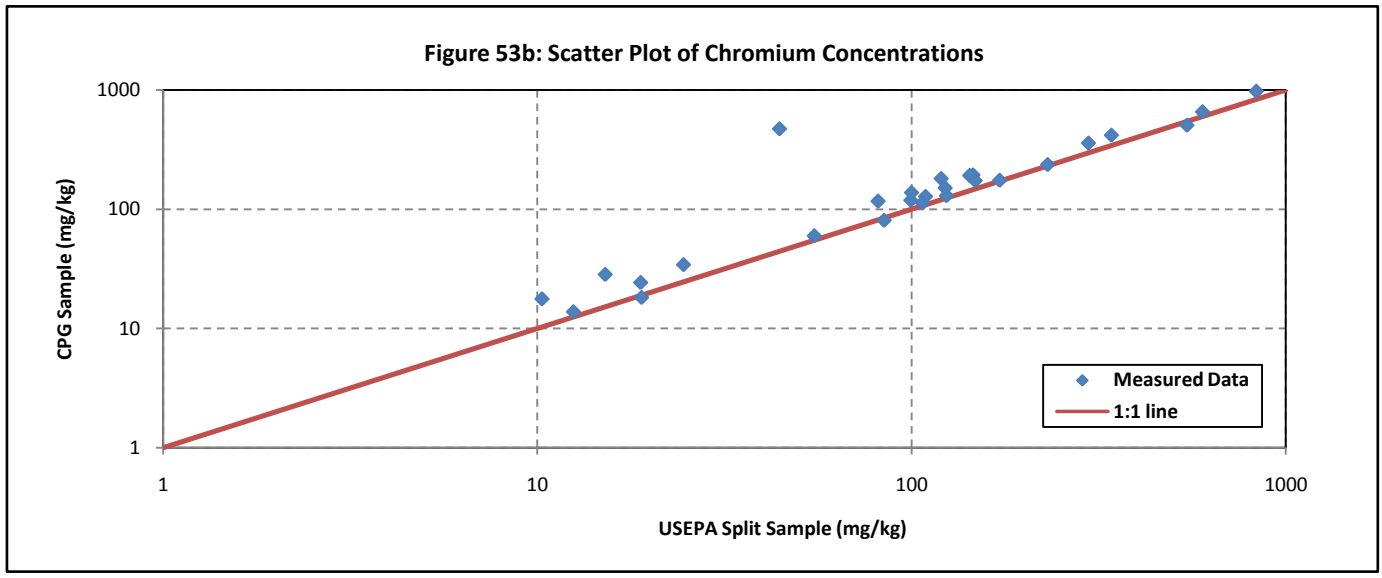


Figure 53b: Scatter Plot of Chromium Concentrations
CPG Sample (mg/kg)
1000
100
10
1
Measured Data
1:1 line
1
10
100
1000
USEPA Split Sample (mg/kg)

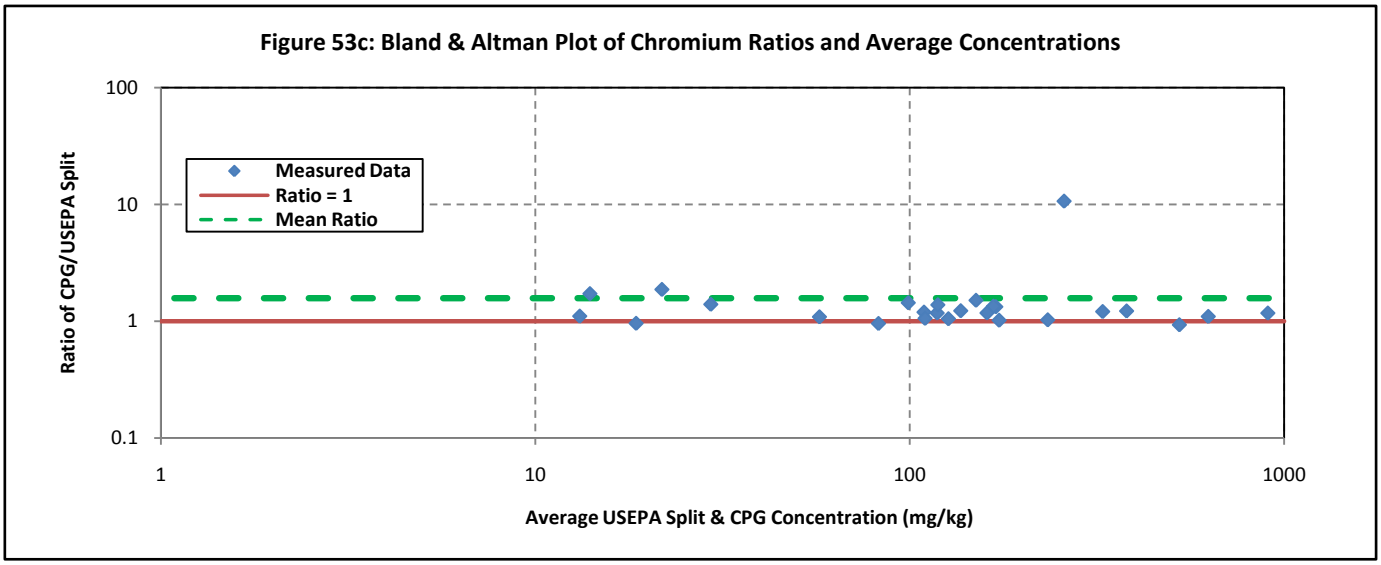


Figure 53c: Bland & Altman Plot of Chromium Ratios and Average Concentrations
Ratio of CPG/USEPA Split
100
10
1
0.1
Measured Data
Ratio = 1
Mean Ratio
1
10
100
1000
Average USEPA Split & CPG Concentration (mg/kg)

Figure 54a: Line Plot of Cobalt Concentrations

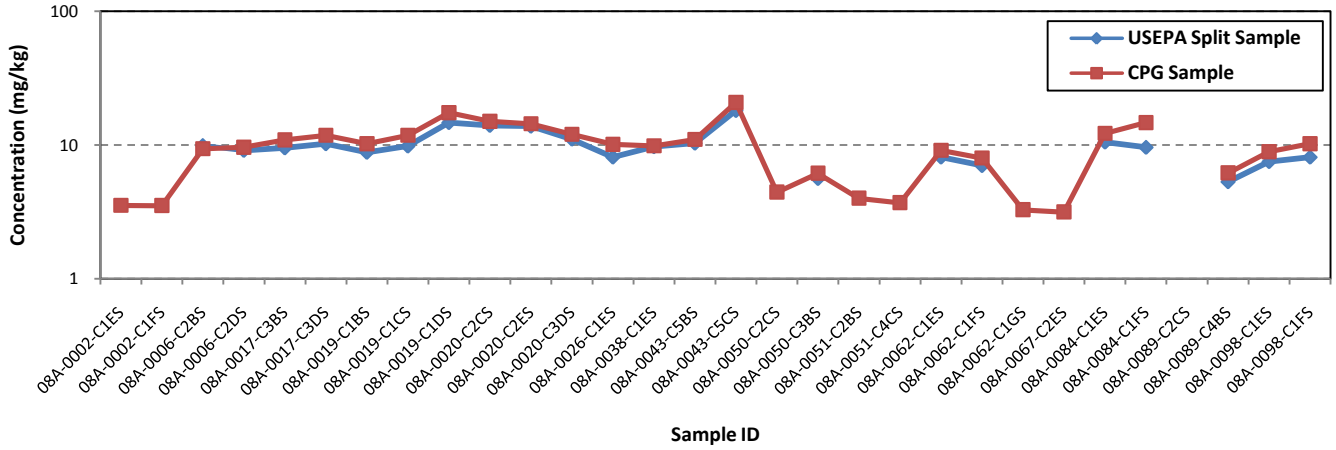


Figure 54b: Scatter Plot of Cobalt Concentrations

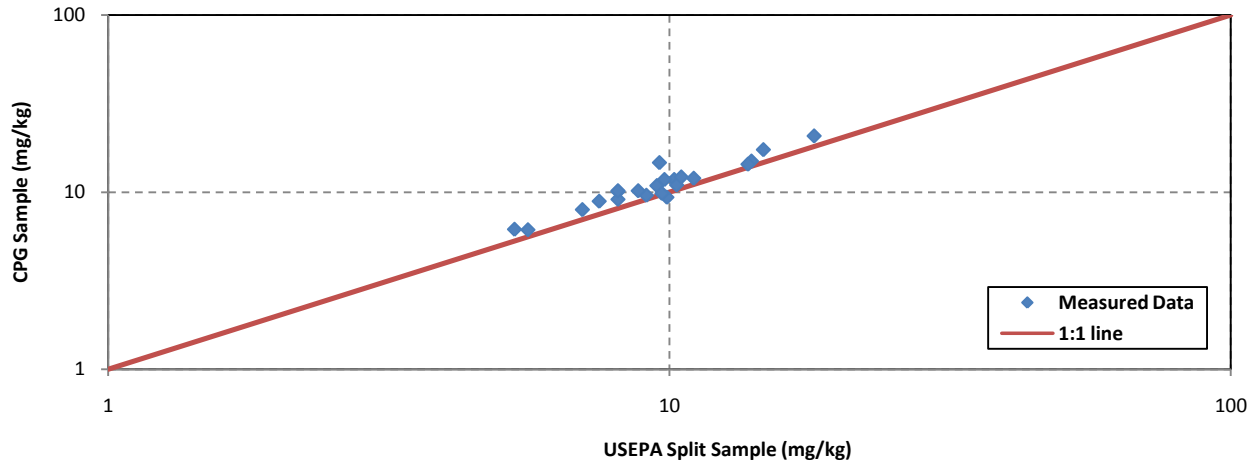


Figure 54c: Bland & Altman Plot of Cobalt Ratios and Average Concentrations

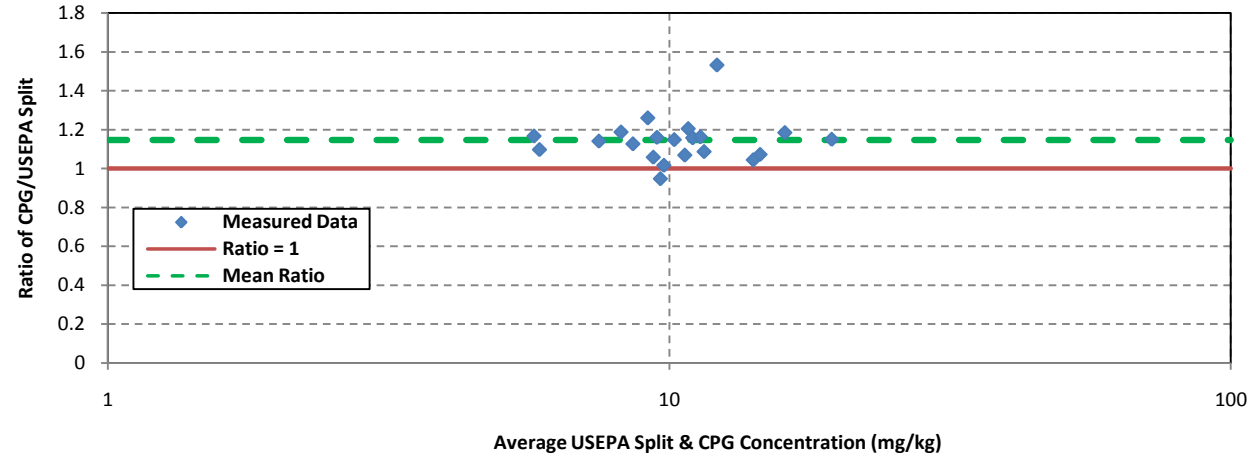


Figure 55a: Line Plot of Copper Concentrations

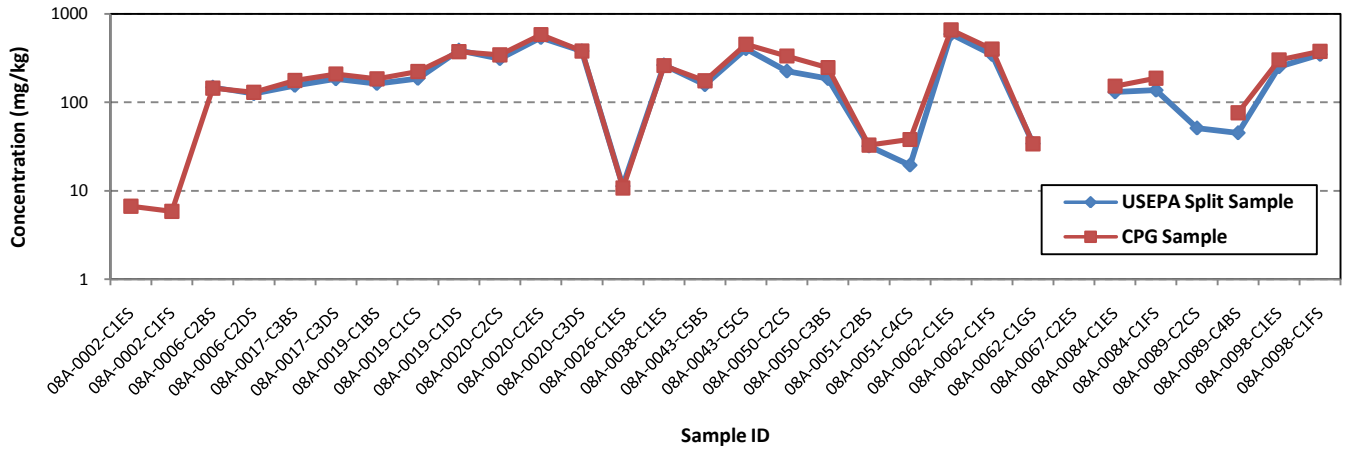


Figure 55b: Scatter Plot of Copper Concentrations

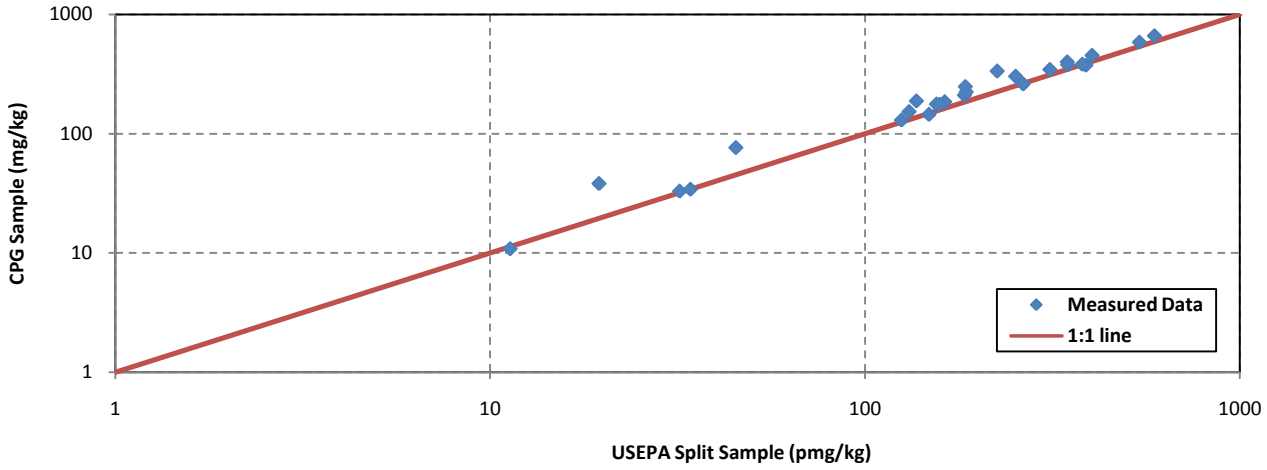
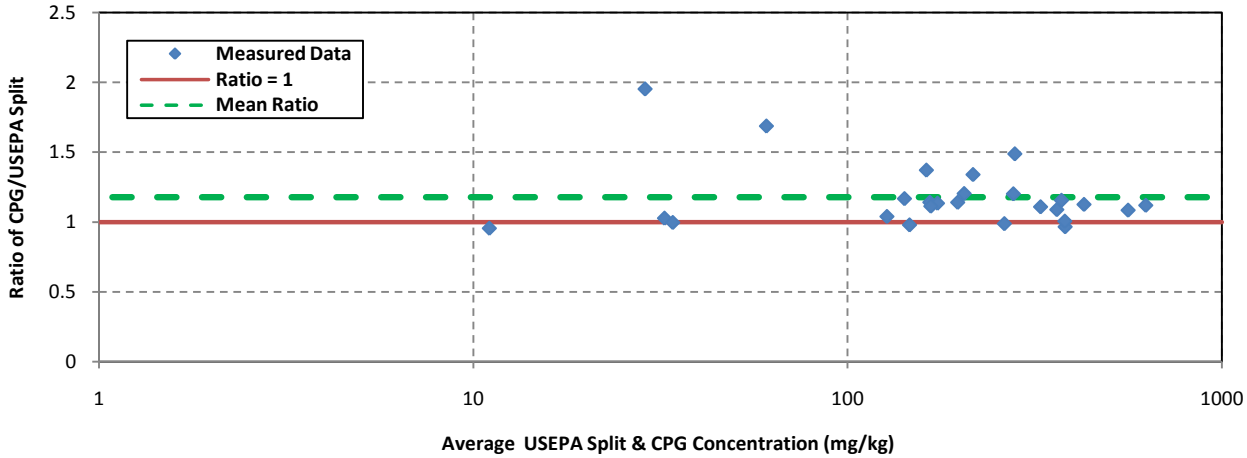


Figure 55c: Bland & Altman Plot of Copper Ratios and Average Concentrations



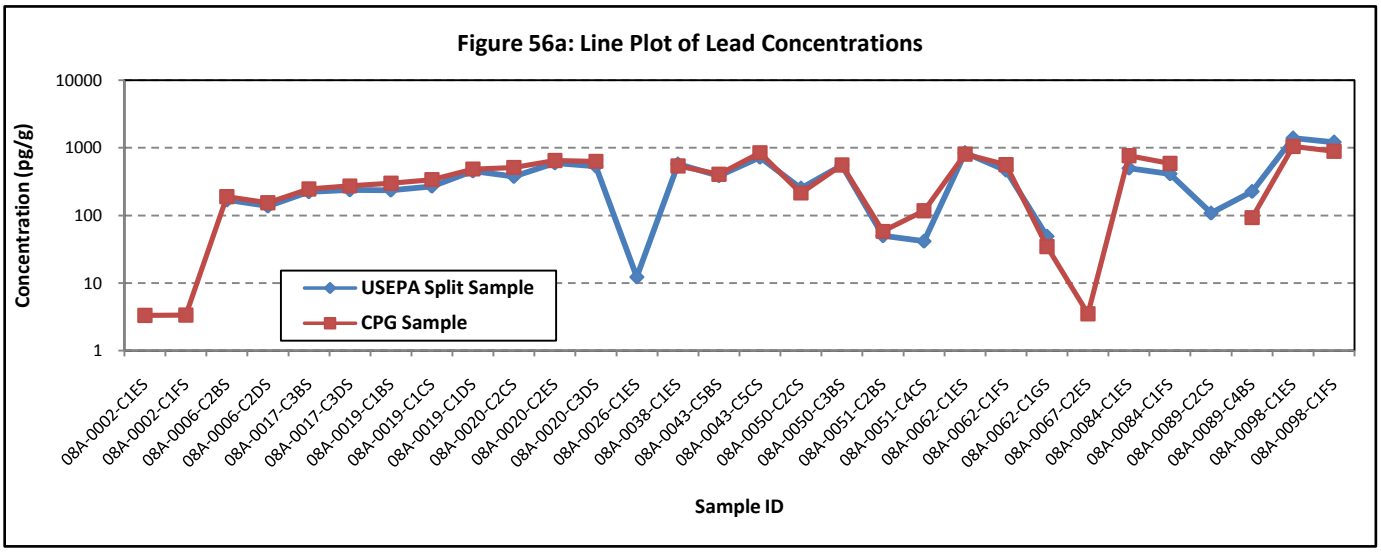


Figure 56a: Line Plot of Lead Concentrations
Concentration (pg/g)
10000
1000
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C2BS
08A-0006-C2DS
08A-0017-C3BS
08A-0017-C3DS
08A-0019-C1BS
08A-0019-C1CS
08A-0019-C1DS
08A-0020-C2CS
08A-0020-C2ES
08A-0020-C3DS
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C5BS
08A-0043-C5CS
08A-0050-C2CS
08A-0050-C3BS
08A-0051-C2BS
08A-0051-C4CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2CS
08A-0089-C4BS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

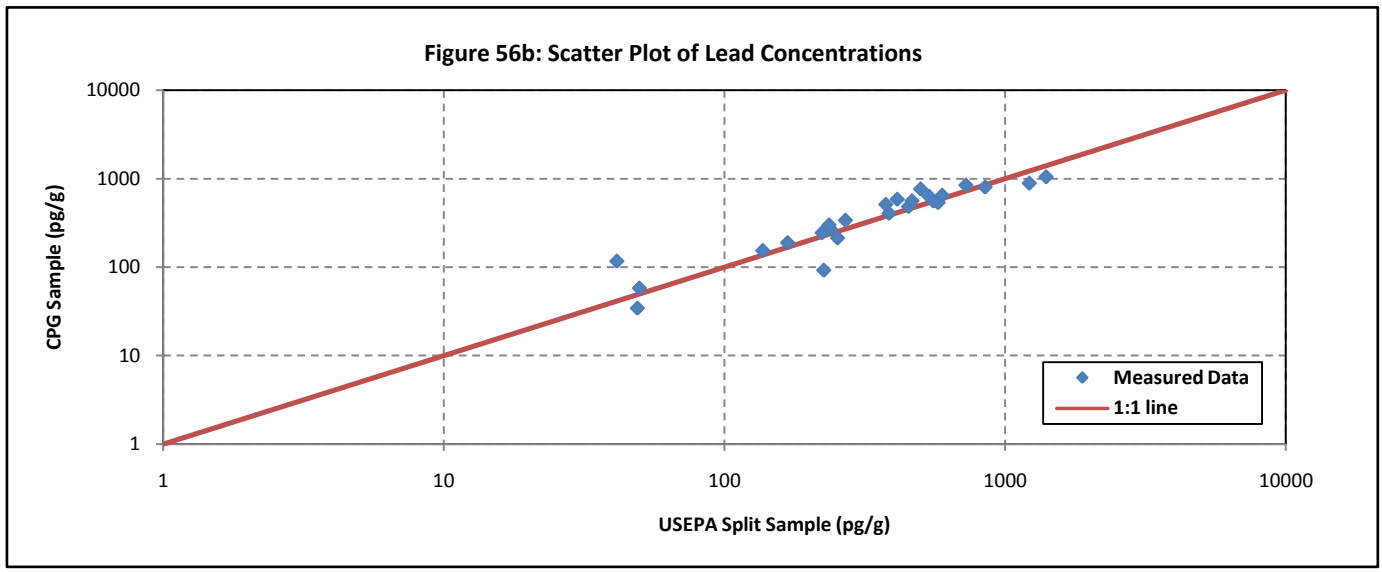


Figure 56b: Scatter Plot of Lead Concentrations
CPG Sample (pg/g)
10000
1000
100
10
1
Measured Data
1:1 line
1
10
100
1000
10000
USEPA Split Sample (pg/g)

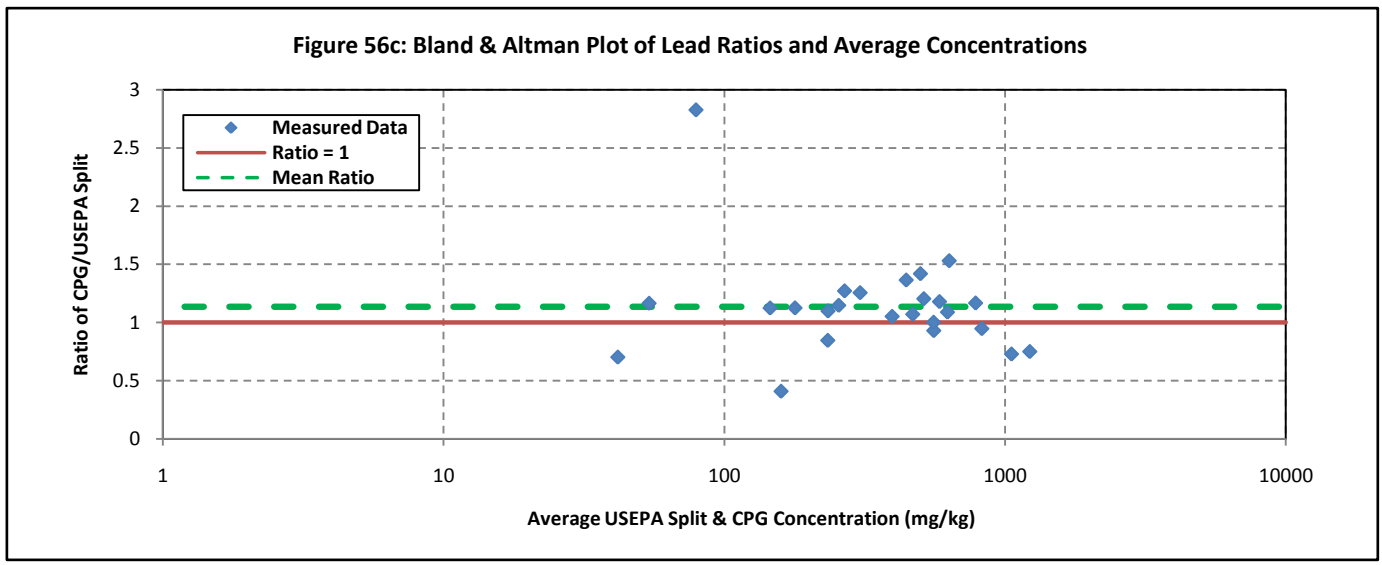


Figure 56c: Bland & Altman Plot of Lead Ratios and Average Concentrations
Ratio of CPG/USEPA Split
3
2.5
2
1.5
1
0.5
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
1000
10000
Average USEPA Split & CPG Concentration (mg/kg)

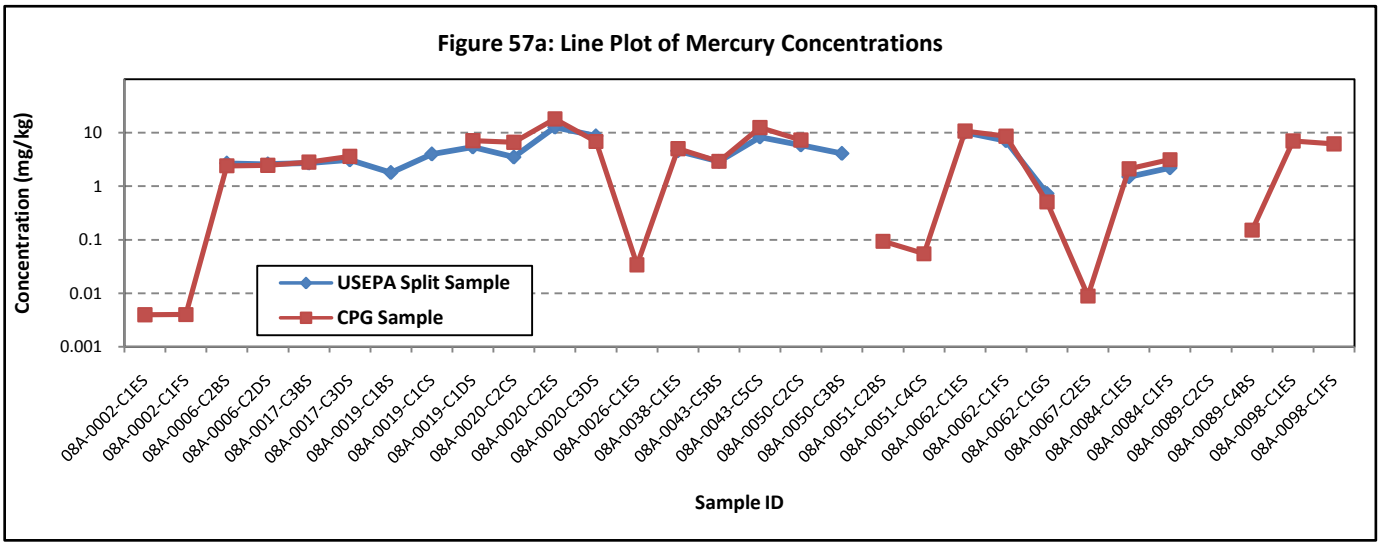


Figure 57a: Line Plot of Mercury Concentrations
Concentration (mg/kg)
10
1
0.1
0.01
0.001
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C2BS
08A-0006-C2DS
08A-0017-C3BS
08A-0017-C3DS
08A-0019-C1BS
08A-0019-C1CS
08A-0019-C1DS
08A-0020-C2CS
08A-0020-C2ES
08A-0020-C3DS
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C5BS
08A-0043-C5CS
08A-0050-C2CS
08A-0050-C3BS
08A-0051-C2BS
08A-0051-C4CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2CS
08A-0089-C4BS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

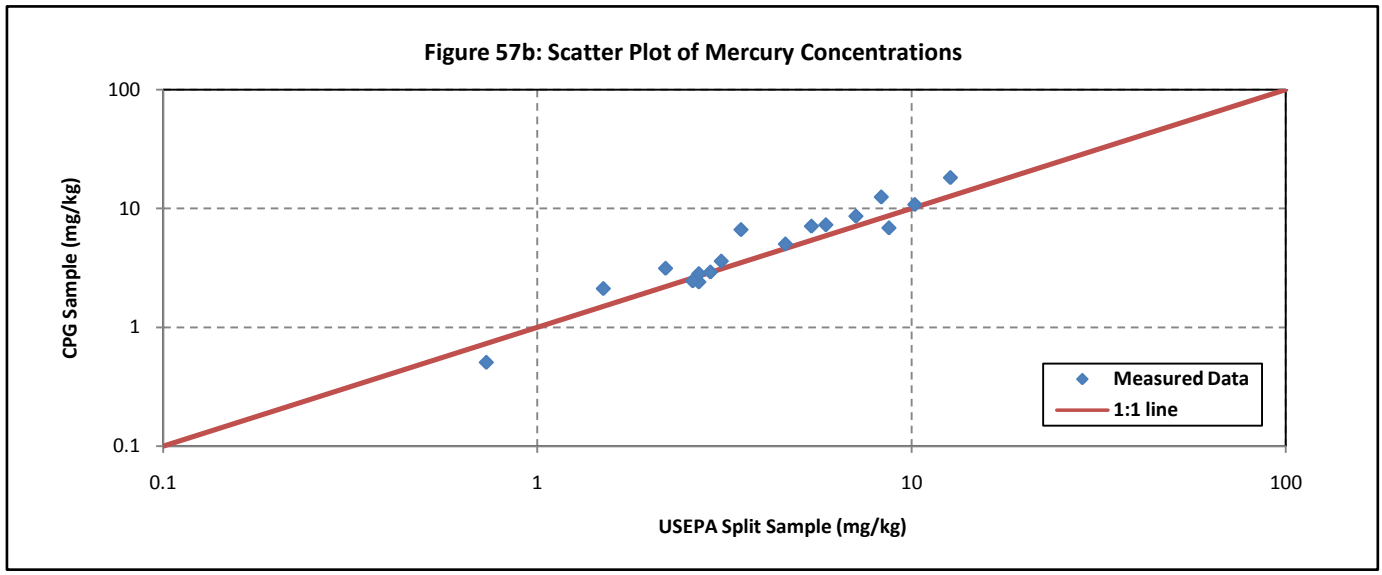


Figure 57b: Scatter Plot of Mercury Concentrations
CPG Sample (mg/kg)
100
10
1
0.1
0.1
1
10
100
Measured Data
1:1 line
USEPA Split Sample (mg/kg)

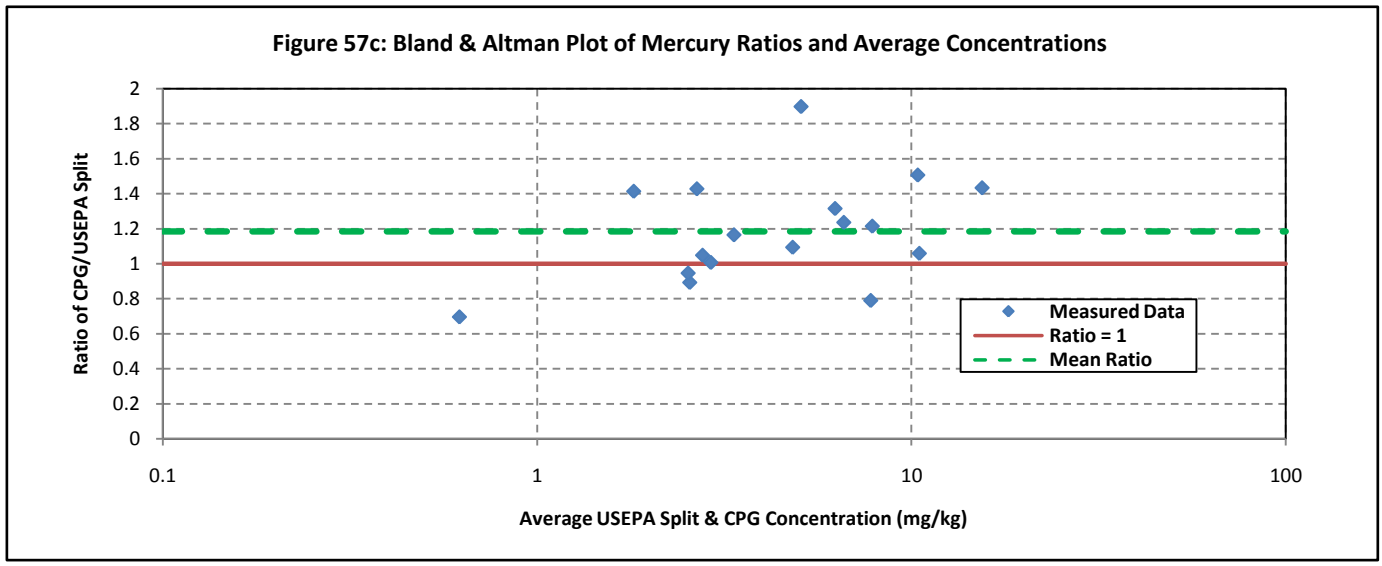


Figure 57c: Bland & Altman Plot of Mercury Ratios and Average Concentrations
Ratio of CPG/USEPA Split
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.1
1
10
100
Measured Data
Ratio = 1
Mean Ratio
Average USEPA Split & CPG Concentration (mg/kg)

Figure 58a: Line Plot of Nickel Concentrations

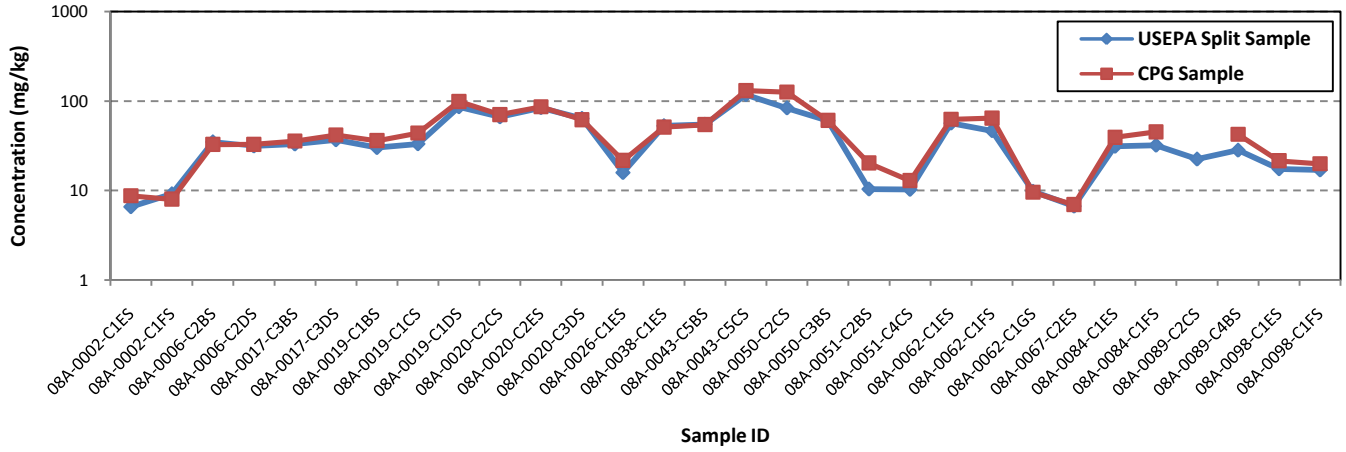


Figure 58b: Scatter Plot of Nickel Concentrations

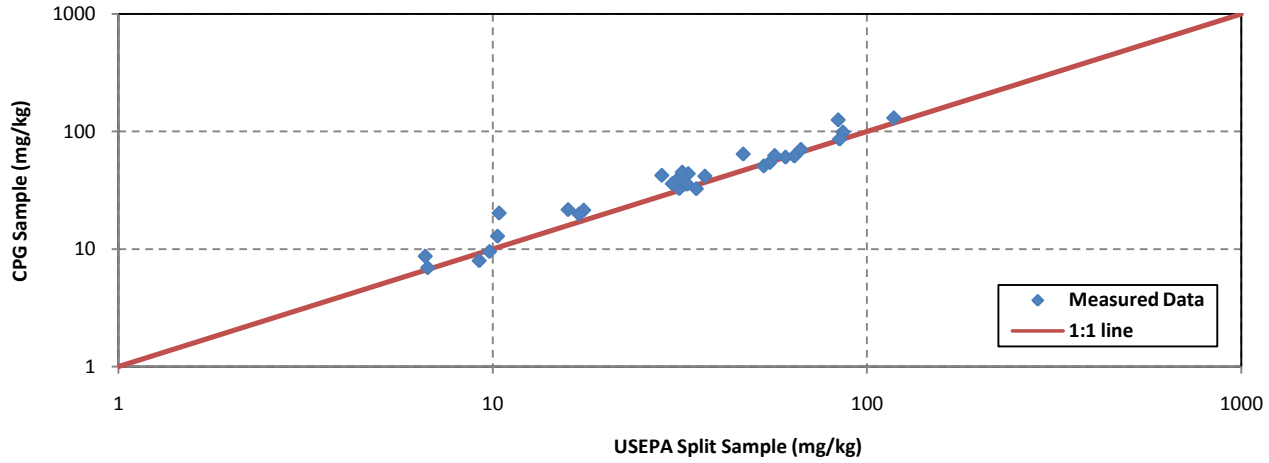
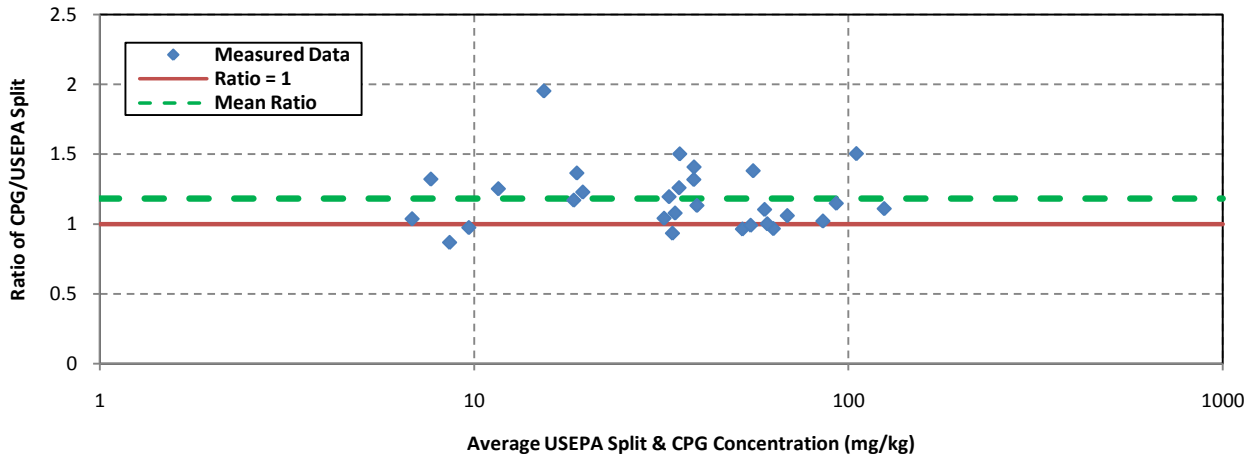


Figure 58c: Bland & Altman Plot of Nickel Ratios and Average Concentrations



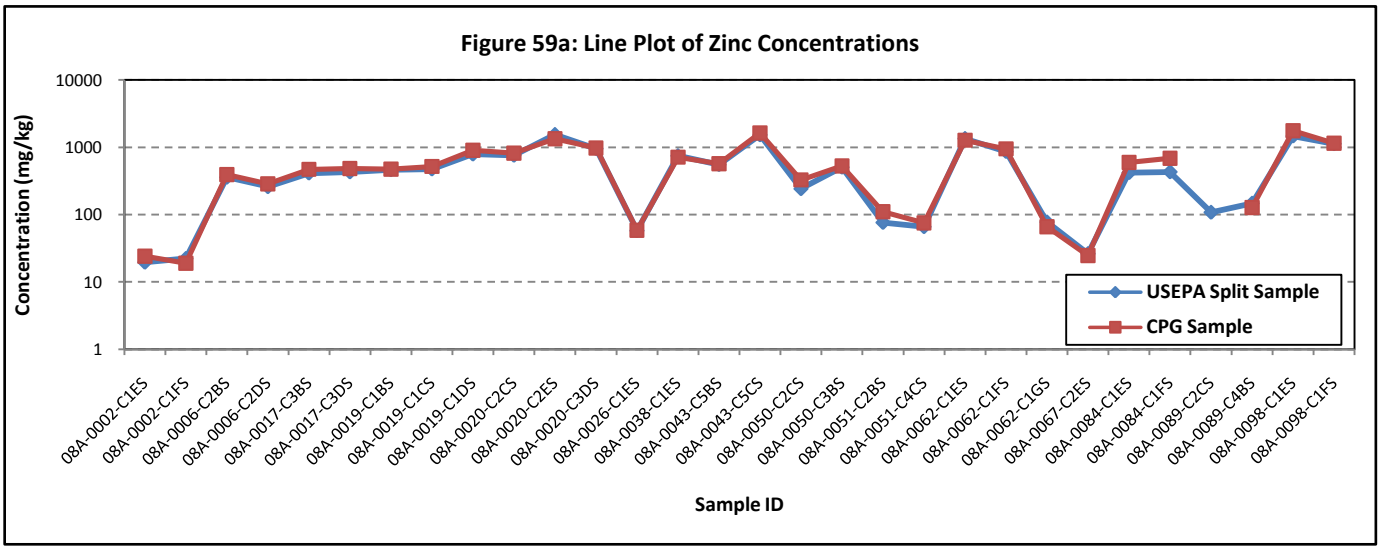


Figure 59a: Line Plot of Zinc Concentrations
Concentration (mg/kg)
10000
1000
100
10
1
USEPA Split Sample
CPG Sample
08A-0002-C1ES
08A-0002-C1FS
08A-0006-C2BS
08A-0006-C2DS
08A-0017-C3BS
08A-0017-C3DS
08A-0019-C1BS
08A-0019-C1CS
08A-0019-C1DS
08A-0020-C2CS
08A-0020-C2ES
08A-0020-C3DS
08A-0026-C1ES
08A-0038-C1ES
08A-0043-C5BS
08A-0043-C5CS
08A-0050-C2CS
08A-0050-C3BS
08A-0051-C2BS
08A-0051-C4CS
08A-0062-C1ES
08A-0062-C1FS
08A-0062-C1GS
08A-0067-C2ES
08A-0084-C1ES
08A-0084-C1FS
08A-0089-C2CS
08A-0089-C4BS
08A-0098-C1ES
08A-0098-C1FS
Sample ID

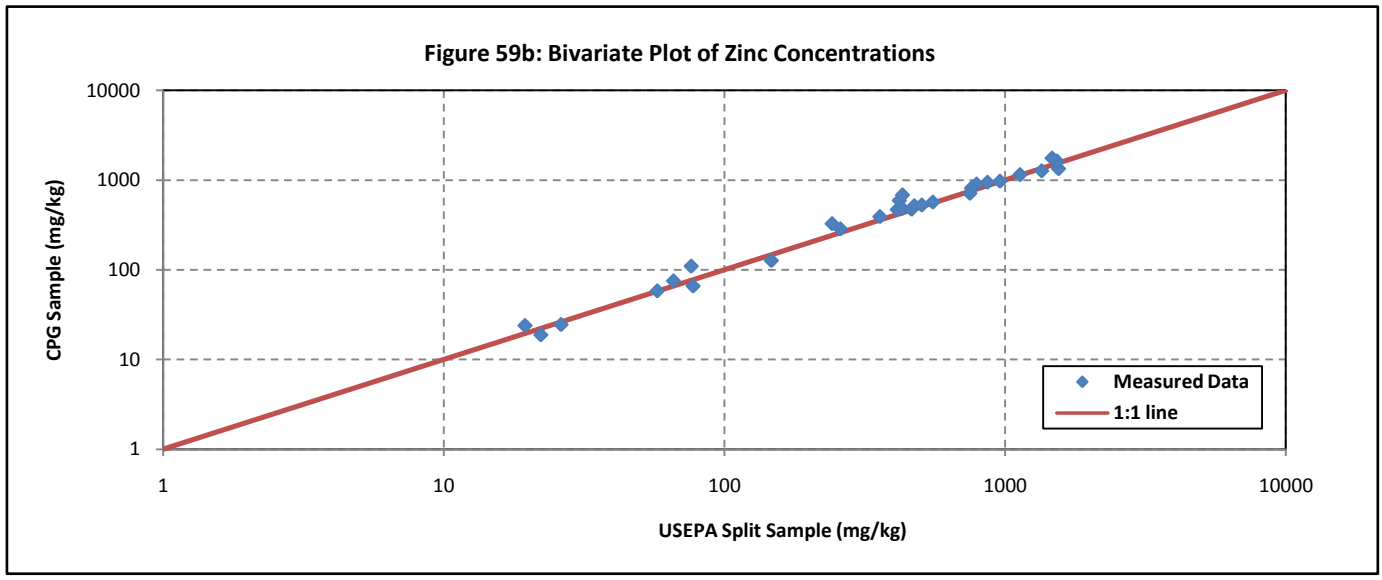


Figure 59b: Bivariate Plot of Zinc Concentrations
CPG Sample (mg/kg)
10000
1000
100
10
1
Measured Data
1:1 line
1
10
100
1000
10000
USEPA Split Sample (mg/kg)

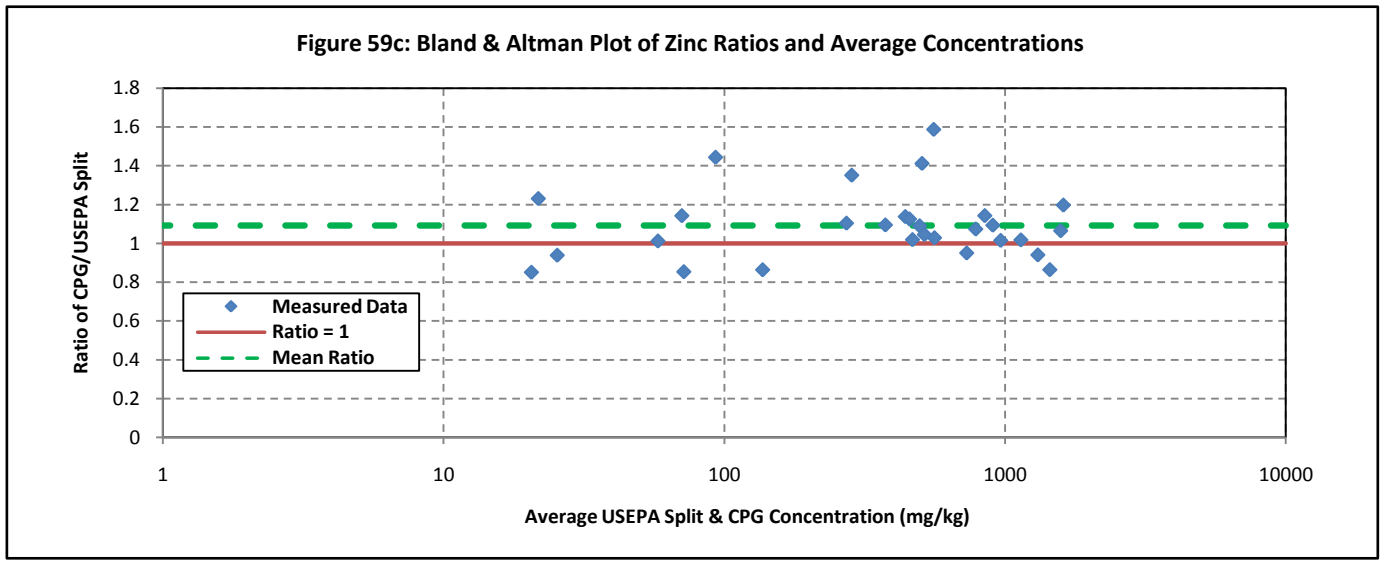


Figure 59c: Bland & Altman Plot of Zinc Ratios and Average Concentrations
Ratio of CPG/USEPA Split
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Measured Data
Ratio = 1
Mean Ratio
1
10
100
1000
10000
Average USEPA Split & CPG Concentration (mg/kg)

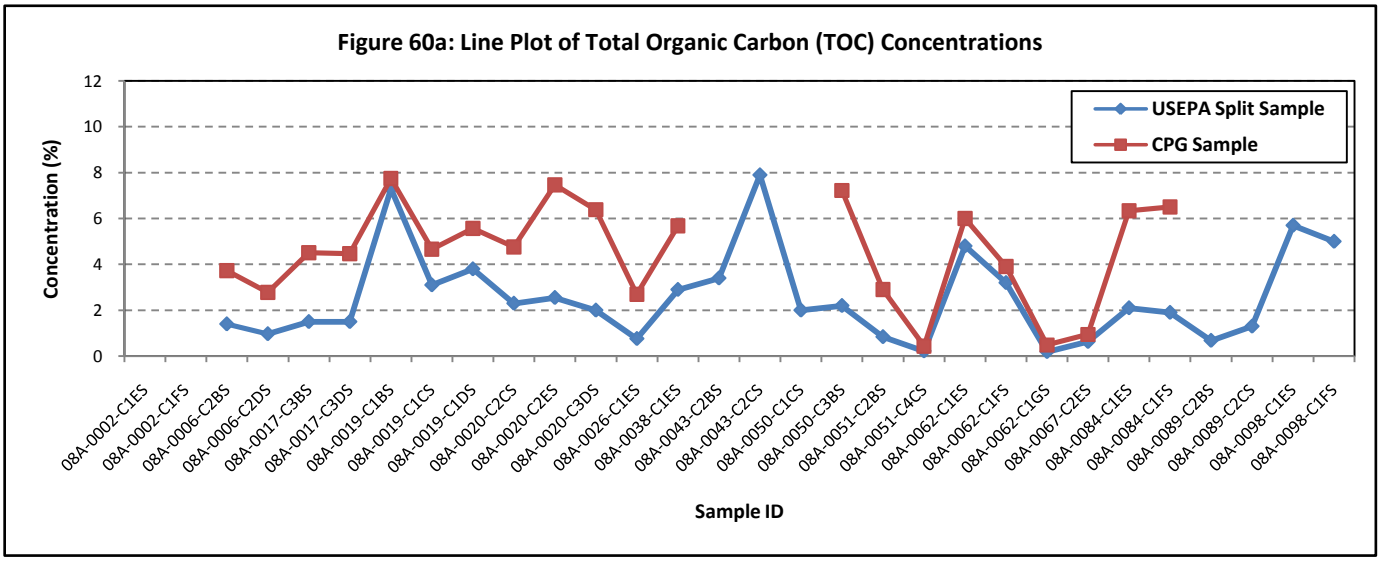


Figure 60a: Line Plot of Total Organic Carbon (TOC) Concentrations
Concentration (%)
USEPA Split Sample
CPG Sample
Sample ID

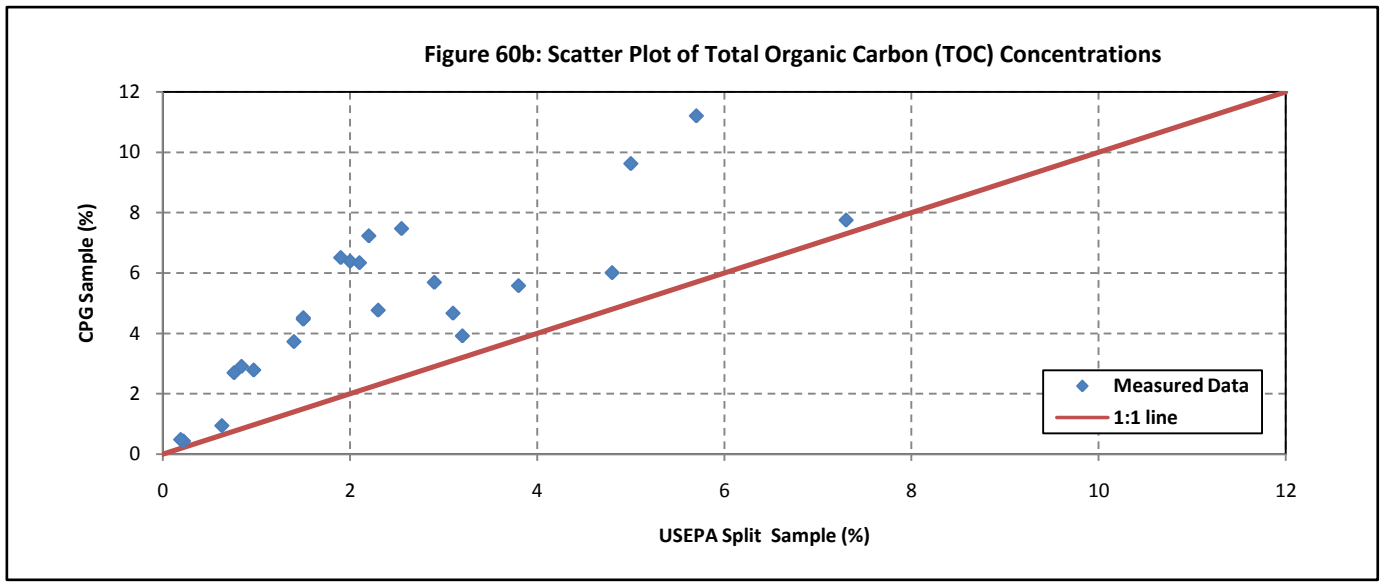


Figure 60b: Scatter Plot of Total Organic Carbon (TOC) Concentrations
CPG Sample (%)
Measured Data
1:1 line
USEPA Split Sample (%)

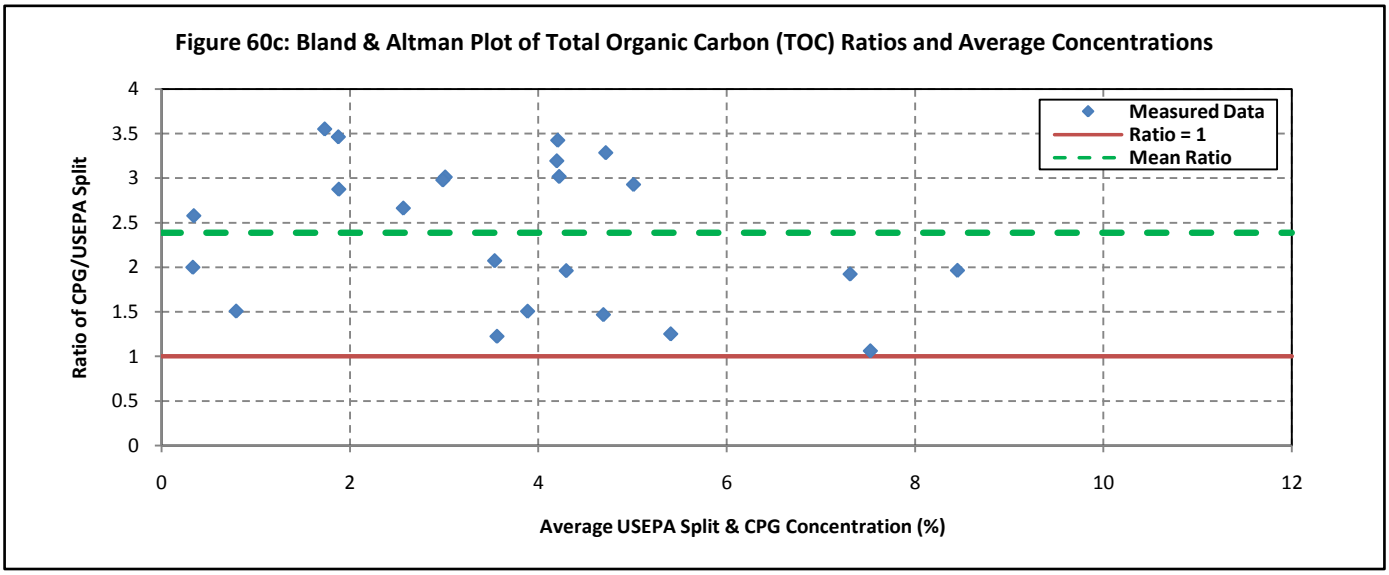


Figure 60c: Bland & Altman Plot of Total Organic Carbon (TOC) Ratios and Average Concentrations
Ratio of CPG/USEPA Split
Measured Data
Ratio = 1
Mean Ratio
Average USEPA Split & CPG Concentration (%)

Attachment E

Independent Investigation Reports (prepared by CSC Environmental Solutions and Interface, Inc., dated March 16, 2010 and January 2011)

Report on Suspected Causes of Disparities between the Results Produced by Columbia Analytical Services and AXYS Analytical Services in Analysis of Lower Passaic River Sediment Split Samples for Chlorinated Dibenzo-*p*-Dioxins and Dibenzofurans, and Development of a Conversion Factor to Adjust Results between the Two Laboratories

prepared by

Environmental Solutions
6101 Stevenson Avenue
Alexandria VA 22304

and

Interface, Inc.
P.O. Box 297
Fort Collins, CO 80522

March 2010

Summary

This report suggests causes for observed disparities in analytical results produced by Columbia Analytical Services (CAS) and AXYS Analytical Services (AXYS) in analysis of split sediment samples collected in 2008 from the Lower Passaic River. The samples were analyzed by both laboratories using their own modifications to EPA Method 1613B: *Tetra- Through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS*. For 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (2,3,7,8-TCDD; dioxin), sediment concentrations reported by CAS were, on average, approximately one-half the concentrations reported by AXYS. The suspected cause of these disparities is believed to be one or more differences in the extraction techniques used by the laboratories.

In the course of investigating potential causes of the disparities, three sets of split sample data were examined. For analyses of its portion of the splits, AXYS used dehydration with a large amount of sodium sulfate and Soxhlet extraction with an 80:20 toluene:acetone solvent mixture. The procedures used by the other laboratories are as follows:

- 2005 and 2007 samples from Newark Bay – Vista Analytical (Vista; formerly Alta Analytical) used the Soxhlet/Dean-Stark (SDS) extractor specified in Method 1613B. Results showed that Vista's SDS procedure extracted approximately 13 percent less 2,3,7,8-TCDD than AXYS' procedure. This difference was statistically significantly different at the 95% confidence level.
- 2008 samples from the Lower Passaic River – CAS used dehydration with a relatively smaller amount of sodium sulfate (as compared to AXYS) and Soxhlet extraction with toluene. Results showed that AXYS' procedure extracted approximately twice as much 2,3,7,8-TCDD as the CAS procedure. This difference was statistically significantly different at the 95% confidence level.
- 2009 samples from the Lower Passaic River – Analytical Perspectives (AP) used the SDS extractor specified in Method 1613B. Results showed that AP's SDS procedure extracted 7% more 2,3,7,8-TCDD than AXYS' procedure. However, this difference was not statistically significant at the 95% confidence level.

The conclusion from these data is that the AXYS procedure extracts amounts of 2,3,7,8-TCDD equal to or slightly greater than SDS, as practiced by Vista and AP, whereas the CAS procedure extracts approximately half as much. Because the CAS procedure extracts only half as much 2,3,7,8-TCDD as the AXYS procedure, an adjustment of the CAS results, in the form of a "correction factor," may be appropriate. In order to develop a correction factor for the CAS results, the results produced by AXYS must be presumed to be "true values." Application of a correction factor would likely result in some decrease in the systematic error, but would result in an increase in random error. Given this qualification, a correction factor of 0.53 was determined by calculating the geometric mean of the CAS-AXYS ratio of results for 2,3,7,8-TCDD in the 2008 data. This factor is significantly different from 1 at the 95% confidence level. Using this factor, CAS results for dioxin would need to be divided by 0.53 (or multiplied by 1.887) to adjust them to the equivalent AXYS values. Suggested geometric mean correction factors for the other 2,3,7,8-substituted polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (PCDDs/PCDFs) are provided in this report.

Report on Suspected Causes of Disparities between the Results Produced by Columbia Analytical Services and AXYS Analytical Services in Analysis of Lower Passaic River Sediment Split Samples for Chlorinated Dibenzo-p-Dioxins and Dibenzofurans, and Development of a Conversion Factor to Adjust Results between the Two Laboratories

Introduction

In October of 2009, Alice Yeh, EPA Region 2, contacted the Office of Water, Engineering and Analysis Division (EAD), Engineering and Analytical Support Branch (EASB) for assistance in finding the reason(s) for disparities in results between Columbia Analytical Services (CAS) and AXYS Analytical Services (AXYS) for determination of 2,3,7,8-substituted polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (PCDDs/PCDFs) in split sediment samples from studies in the Lower Passaic River in 2008. CAS analyzed the split samples between August 2008 and April 2009 for a Cooperating Parties Group (CPG) of potentially responsible parties (PRPs). AXYS analyzed the split samples between October 2008 and January 2009 for EPA.

Region 2 requested that EASB help with the following two tasks:

- Attempt to determine a reason or reasons for the systematic bias in the data, and
- If possible and appropriate, provide a correction factor that would allow the full 2008 CAS data set for PCDDs/PCDFs to be adjusted for the disparity.

During a conference call on December 17, 2009, information came to light regarding 2005 and 2007 data on split sediment samples from Newark Bay analyzed by AXYS and Vista Laboratories, and 2009 data on split sediment samples from the Lower Passaic River analyzed by AXYS and Analytical Perspectives (AP). In light of these data, a task was added to determine if results of analyses of the 2005/2007 Newark Bay and 2009 Lower Passaic River sediment samples would aid in resolving disparities in results of analyses of the 2008 Passaic River sediment samples. In the end, they did.

EASB assigned these tasks to its contractor, Computer Sciences Corporation (CSC), who in turn, requested assistance from its subcontractor, Interface, Inc. CSC and Interface, Inc. are collectively referred to in this report as "CSC" or "we."

In October and November of 2009, Region 2 provided results of analyses of the 2008 Lower Passaic River split sediment samples, standard operating procedures (SOPs) from CAS and AXYS, and various supporting data. After review of these initial data, CSC developed a list of questions and requests to be forwarded to CAS through CPG and to AXYS through Region 2. Throughout much of November and into early December of 2009, CSC received further SOPs, data, and responses to questions and initiated additional requests for information from both CAS and AXYS. In February of 2010, CSC received results of analyses of the 2005/2007 Newark Bay and 2009 Lower Passaic River split sediment samples.

The remainder of this report describes CSC's examination of the information supplied by Region 2, CAS, and AXYS, provides CSC's beliefs as to the cause of the disparities, and suggests correction factors for the CAS data.

Investigation of Possible Causes of the Disparity

Comparison of Laboratory SOPs with EPA Method 1613B

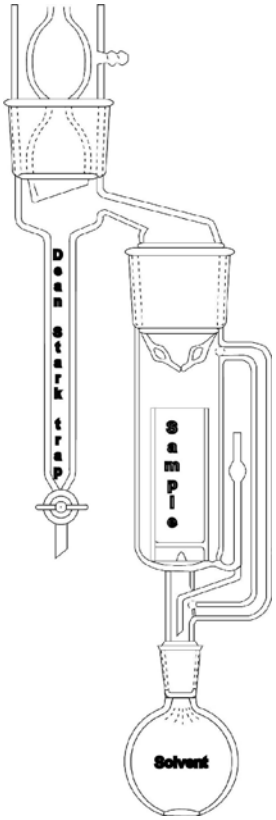
Method 1613B includes various options for extraction of PCDDs/PCDFs from environmental matrices including sediments, cleanup procedures for removing interferences, and high resolution (capillary column) gas chromatography combined with high resolution mass spectrometry (HRGC/HRMS)

determinative procedures for the 17 2,3,7,8-substituted PCDD/PCDF congeners. Method 1613B is not attached to this report but is available at the EPA web site:

http://www.epa.gov/waterscience/methods/method/dioxins/1613.pdf

Both laboratories modified the procedures in EPA Method 1613B and incorporated those modifications into the SOPs used for the analyses of the split samples from the site.

Soxhlet/Dean-Stark Extraction



In thinking about how CAS could obtain results that tended to be lower, though by varying amounts, than those obtained by AXYS, CSC concluded that the most likely problem was in the extraction or cleanup steps. A disparity in results in the determinative step (HRGC/HRMS) would likely cause a more consistent bias. Therefore, CSC focused on differences in the extraction and cleanup steps between the laboratories' SOPs and Method 1613B. Most noticeable was the extraction technique used for the sediment samples. Method 1613B specifies use of a Soxhlet/Dean-Stark (SDS) extractor, shown to the right.

The SDS technique relies on formation of a vapor-phase azeotrope between the extraction solvent toluene and water leached from the sample. As the solvent passes through the sample in the Soxhlet portion of the extractor, it removes the water, allowing the toluene to extract the PCDDs/PCDFs from the matrix. The toluene/water mixture boils in the flask below the sample and the azeotropic vapor rises through the apparatus to a condenser at the top. The azeotrope is broken when the condensed liquid falls into the Dean-Stark trap and forms two layers, with the toluene on top of the water. The water and toluene collect in the Dean-Stark trap until the toluene reaches the top of the trap and overflows onto the sample. The toluene percolates through the sample carrying the PCDDs/PCDFs into the boiling flask. The SDS procedure does not require addition of a dehydrating agent to wet sample matrices such as sediments or soils. Dehydration occurs via the azeotropic distillation.

Neither CAS nor AXYS used the SDS extractor; rather, both laboratories used sodium sulfate for sample dehydration and a Soxhlet extractor for sample extraction. Alternative extraction and other procedures are allowed under the equivalency provisions in Method 1613B. In fact, Method 1613B contains a sample dehydration and Soxhlet extraction procedure for tissue (Section 12.4 of Method 1613B). In that Soxhlet extraction procedure, the condenser sits directly above the sample (i.e., there is no offset of the condenser as in the SDS extractor), and there is no Dean-Stark trap. Sodium sulfate is relied on for dehydration. However, Method 1613B only applies this procedure to tissue samples.

For analyses of the 2005/2007 Newark Bay and 2009 Lower Passaic River samples, AXYS used the same modifications to Method 1613B that were used for analyses of the 2008 Lower Passaic River sediment samples. For the 2005/2007 Newark Bay samples, Vista used Method 1613B as written, including SDS extraction, and for the 2009 Lower Passaic River samples, AP used Method 1613B as written, including SDS extraction.

Recoveries of ^{13}C-labeled PCDDs/PCDFs and ^{37}Cl-labeled 2,3,7,8-TCDD

Method 1613B requires that isotopically labeled standards be added to each sample and sample extract. A suite of fifteen ^{13}C-labeled PCDDs/PCDFs are added (spiked) into each sample prior to extraction. These labeled PCDDs/PCDFs do not occur naturally and are used to quantify the unlabeled target analytes through a technique known as isotope dilution. One other labeled standard, $^{37}Cl_4$-2,3,7,8-TCDD,

is added to each extract prior to cleanup and is used to diagnose problems with the various extract cleanup steps in the method. CSC examined the recoveries of both sets of labeled standards in all of the samples from both laboratories.

Recoveries of the ^{37}Cl-labeled cleanup standard in the split samples were within the quality control (QC) acceptance criteria in Method 1613B and consistent across both laboratories. The observed recoveries eliminated inconsistent cleanup as a possible cause of the disparities and led us to focus on extraction.

As with the cleanup standard, recoveries of the ^{13}C-labeled PCDDs/PCDFs spiked into the samples before extraction were also recovered within expected ranges. However, in development of the SDS technique, Nestrick and Lamparski of the Dow Chemical Company (see References 6 and 7 in EPA Method 1613B) cautioned that compounds spiked onto the surface of a wet solid sample were often easily recovered, whereas PCDDs/PCDFs indigenous to the sample were not so easily recovered because they were more intimately associated with the sample matrix. Thus, labeled compounds recoveries should not be used as the sole measure of performance of a modified method.

Activated, Powdered, Anhydrous Sodium Sulfate

Method 1613B and other environmental analytical methods specify use of powdered sodium sulfate for drying of the sample, and granular sodium sulfate for drying of the sample extract.

Removal of water from the sample prior to extraction is necessary to allow the extraction solvent to enter the pores of the soil/sediment particles and the interstices between them. Compared to the coarser granular form, the small particle size of the powdered form of sodium sulfate allows the drying agent to be mixed well with the sample and permits intimate contact with the soil or sediment particles so that any water can be removed. Therefore, Method 1613B and nearly all other methods that employ dehydration and Soxhlet extraction specify use of baked, powdered, anhydrous sodium sulfate for sample dehydration.

The granular form of sodium sulfate is used in Method 1613B and other analytical methods for removing water from sample extracts. Section 7.2.1 of Method 1613B describes procedures for preparing the granular sodium sulfate used for such extract drying. The procedures in Section 7.2.1 require rinsing the sodium sulfate with methylene chloride, baking at 400 °C for 1 hour minimum to remove any sorbed water to ensure it is anhydrous, cooling in a desiccator, and storage in a clean glass bottle with screw cap that prevents moisture from entering.

The specifications for powdered sodium sulfate are found in Section 7.2.2 of Method 1613B. Because both forms of sodium sulfate (granular and powdered) can be prepared using the same procedures, Section 7.2.2 references the procedure in Section 7.2.1.

In reviewing SOPs from CAS and AXYS, we found that neither laboratory rinsed the sodium sulfate with methylene chloride. We also found that AXYS baked the sodium sulfate at a temperature of 325 ºC for 8 hours, whereas CAS used the sodium sulfate as received, without baking. Further, both AXYS and CAS used granular anhydrous sodium sulfate, in contrast to the requirement to use powdered, anhydrous sodium sulfate in Method 1613B and in other methods that use sodium sulfate for dehydration (e.g., EPA's Contract Laboratory Program SOW DLM02.0 *Multi-Media, Multi-Concentration Dioxins and Furans Analysis*). The differences among the Method 1613B procedure for tissue and the procedures in the CAS and AXYS SOPs are summarized in Table 1.

The use of granular sodium sulfate by AXYS, rather than powdered, may have been offset by use of the much larger amount of sodium sulfate (75 - 100 g) than the amount used by CAS (5 - 10 g), and the amount specified for use in the extraction procedure for tissue in Method 1613B (40 - 50 g for a 10-g sample). Other contributing factors to the higher concentrations of PCDDs/PCDFs measured by AXYS, relative to the concentrations measured by CAS, may be the use of a toluene:acetone (80:20) co-solvent

mixture by AXYS, rather than toluene alone used by CAS and specified in Method 1613B, and a drying time of 30 min after the sodium sulfate had been mixed with the sample by AXYS, but not by CAS.

Table 1. Comparison of Soxhlet Extraction in Method 1613B and the Procedures used by CAS and Axys*

Item	EPA Method 1613B Tissue Procedure	CAS Sediment Procedure	Axys Sediment Procedure
Solvent	toluene	toluene	toluene:acetone 80:20
Sodium sulfate			
Type	powdered	granular	granular
Amount	30 - 40 g for 10 g sample	5 - 10 g for 3 g sample	75 - 100 g or until a free flowing powder for 10 g sample
Baking temperature	400 °C for 1 h	none (used as received)	325 °C for at least 8 h
Supplier	Baker, or equivalent	EMD Chemicals	Baker
Drying time	12 - 24 h	none	30 min

*Details of other EPA methods that use sodium sulfate and Soxhlet extraction for dioxins/furans:
EPA SW-846 Method 8290A uses 10 g of powdered sodium sulfate for a 10-g sample, but requires adding more to achieve a free-flowing powder. Sodium sulfate is baked at 400 °C for 4 h. No drying time before extraction is specified. Method 8290A explicitly allows the use of the SDS extractor for soil/sediment, noting that sodium sulfate is not required when it is used.
EPA Superfund Contract Laboratory Program Statement of Work (SOW) DLM02.0, May 2005, uses 30 - 40 g of powdered sodium sulfate for a 10-g sample and specifies a dry, free-flowing powder with no drying time before extraction. Sodium sulfate is baked at 400 °C for 4 h.

Likely Effects of the CAS Modifications to Method 1613B

We speculate that CAS' use of granular sodium sulfate, lack of baking of the sodium sulfate, use of a smaller relative amount of sodium sulfate, and/or lack of a drying period, led to reduced concentrations of 2,3,7,8-TCDD and other PCDDs/PCDFs relative to the results from AXYS for the split samples. We emphasize that this speculation has not been proved because neither CAS nor AXYS performed the analysis with and without these modifications on the same sample at the same time, or used the SDS extractor. However, the higher results for the split samples from AXYS suggest that this speculation is correct.

Comparative Data on Wet Sediments

During the conference call on December 17, 2009, we asked if either laboratory had data comparing SDS to their respective procedure for wet sediments similar to the Lower Passaic River samples. AXYS stated that they had intercomparison study data on sediments and had data from standard reference materials (SRMs), but did not have comparative data between SDS and their procedure on naturally occurring wet sediments. When questioned further, AXYS noted that they have performed analyses of some SRMs to which they have added water, but that the intercomparison studies over the years have involved dry matrices. CAS indicated that they have data from dry SRMs, but also did not have comparative data on naturally occurring wet sediments.

Attempt to Correlate the Disparity with Percent Moisture

We believe that lack of use of baked, powdered sodium sulfate by CAS, and use of a relatively smaller amount of granular sodium sulfate compared to AXYS, prevented complete sample dehydration and, therefore, hindered extraction of the PCDDs/PCDFs. We attempted to correlate the magnitude of the disparity in results between the two laboratories with moisture content of the samples. Figure 1 shows a plot of the CAS-to-AXYS ratio for 2,3,7,8-TCDD as a function of percent moisture.

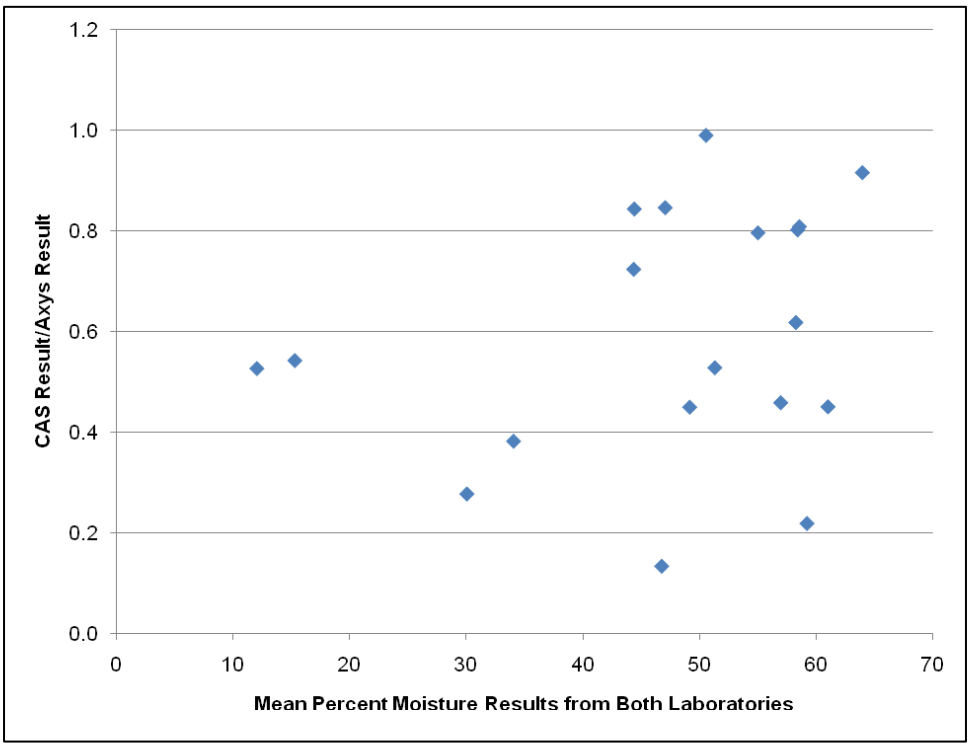


Figure 1. Ratio of CAS to AXYS 2,3,7,8-TCDD Results vs. Mean Percent Moisture

If moisture alone were affecting extraction of the PCDDs/PCDFs, we would expect that the CAS/AXYS ratio would decrease as percent moisture increased. However, the observed correlation was very weak (Spearman rank correlation = 0.21 for pairs for which both labs detected 2,3,7,8-TCDD above the laboratory-specific quantitation limit), and it was not statistically significantly different from 0 at the 95% confidence level. The reason for the lack of a strong correlation may be that the amount of sodium sulfate that CAS added varied between 5 and 10 grams, or that some portion of the sediment was more fully dehydrated in some samples than in others. We also plotted ratios for all 17 PCDDs/PCDFs on the same graph and arrived at the same conclusion as found for 2,3,7,8-TCDD; i.e., there is no correlation. Spearman rank correlations calculated between the percent moisture and CAS-to-AXYS ratio were not statistically significant at the 95% confidence level for any of the other PCDDs/PCDFs. We sought other variables that could be used to correlate the disparity in results, but found none.

Results from Analyses of 2005/2007 Newark Bay Split Sediment Samples

During the conference call on December 17, 2009, we learned that 47 split sediment samples from Newark Bay had been analyzed by AXYS and by Vista. AXYS used the same extraction procedure used for analyses of the Lower Passaic River sediment samples, whereas Vista used the SDS procedure in Method 1613B. The Newark Bay samples allowed a direct comparison of the AXYS procedure with SDS (as practiced by Vista) to ascertain if the procedures extracted the same amounts of material. Table 2 shows that, on average, the amount of 2,3,7,8-TCDD extracted by Vista with SDS was 13 percent less than the amount extracted by AXYS (the geometric mean of the Vista/Axys ratio is 0.87, or 87%)

The individual congener-specific geometric means ranged between 0.67 (1,2,3,7,8,9-HxCDD) and 3.61 (1,2,3,7,8,9-HxCDF), with a median geometric mean of 0.85. For 12 of the 17 congeners, the confidence interval did not include 1.0, indicating that the bias between laboratories for these congeners was statistically significant at the 95% confidence level. The widths of the confidence intervals are affected by the number of sample results available for the analyte, sometimes with striking effects (see 1,2,3,7,8,9-HxCDF for example).

Table 2. Geometric Means of 2005/2007 Newark Bay Vista/AXYS Ratios and Associated Confidence Intervals

PCDD/PCDF	n*	Vista/AXYS Geometric Mean	Confidence Intervals	
			95% Lower Limit	95% Upper Limit
2,3,7,8-TCDD	47	0.87	0.77	0.98
2,3,7,8-TCDF	43	0.96	0.88	1.05
1,2,3,7,8-PeCDD	47	0.85	0.78	0.92
1,2,3,7,8-PeCDF	42	1.00	0.94	1.07
2,3,4,7,8-PeCDF	44	1.04	0.94	1.14
1,2,3,4,7,8-HxCDD	49	0.84	0.77	0.92
1,2,3,6,7,8-HxCDD	52	0.80	0.75	0.86
1,2,3,7,8,9-HxCDD	53	0.67	0.61	0.73
1,2,3,4,7,8-HxCDF	48	0.86	0.76	0.97
1,2,3,6,7,8-HxCDF	43	0.94	0.87	1.02
1,2,3,7,8,9-HxCDF	15	3.61	2.25	5.77
2,3,4,6,7,8-HxCDF	44	0.82	0.71	0.94
1,2,3,4,6,7,8-HPCDD	54	0.84	0.78	0.91
1,2,3,4,6,7,8-HPCDF	50	0.84	0.76	0.93
1,2,3,4,7,8,9-HPCDF	41	0.94	0.85	1.04
OCDD	54	0.78	0.71	0.86
OCDF	50	0.85	0.75	0.96
Median		0.85		

*Includes only pairs for which both results exceeded their corresponding detection limit

A conclusion from the data for all 17 analytes is that SDS extracts, on average, approximately 15 percent less of the analytes than the AXYS procedure (the median ratio is 0.85 or 85%), although this conclusion has not been proven conclusively because different laboratories used the procedures at different times. The significant conclusion for the purpose of this examination is that the AXYS procedure and SDS (as practiced by Vista) both extract significantly more PCDDs/ PCDFs than the CAS procedure, indicating that the CAS results are biased low.

Results from Analyses of 2009 Lower Passaic River Split Sediment Samples

During the conference call on December 17, 2009, we also learned that split sediment samples from the Lower Passaic River had been analyzed in 2009 by AXYS and by AP. AXYS used the same extraction procedure used for analyses of the 2008 Lower Passaic River sediment samples, whereas AP used the SDS procedure in Method 1613B. The 2009 Lower Passaic River samples allowed a further direct comparison of AXYS procedure with SDS to ascertain if the procedures extracted the same amounts of material. Table 3 shows that, on average, the amount of 2,3,7,8-TCDD extracted by SDS (as practiced by AP) was 7% greater than the amount extracted by AXYS. However, the 7% difference is not statistically significant.

For these data, the individual congener-specific geometric means ranged between 0.69 (OCDF) and 1.37 (2,3,4,6,7,8-HxCDF), with a median geometric mean of 0.97. For 3 of the 17 congeners, the confidence interval did not include 1.0, indicating that the bias between laboratories for these congeners was statistically significant at the 95% confidence level. The widths of the confidence intervals in Table 3 tended to be wider than those in Table 2, largely as a consequence of the smaller number of split sample pairs.

The results in Table 3 lend further credence to the conclusion that the AXYS procedure extracts amounts of PCDDs/PCDFs similar to SDS, and that the AXYS procedure and SDS (as practiced by AP or Vista) both extract significantly more PCDDs/PCDFs than the CAS procedure, confirming that the CAS results are biased low.

Table 3. Geometric Means of 2009 Lower Passaic River AP/AXYS Ratios and Associated Confidence Intervals

PCDD/PCDF	n*	AP/AXYS Geometric Mean	Confidence Intervals	
			95% Lower Limit	95% Upper Limit
2,3,7,8-TCDD	9	1.07	0.85	1.33
2,3,7,8-TCDF	10	1.09	1.00	1.19
1,2,3,7,8-PeCDD	9	0.95	0.84	1.08
1,2,3,7,8-PeCDF	9	1.05	0.85	1.31
2,3,4,7,8-PeCDF	10	1.83	1.69	1.98
1,2,3,4,7,8-HxCDD	10	0.92	0.84	1.01
1,2,3,6,7,8-HxCDD	10	0.95	0.87	1.04
1,2,3,7,8,9-HxCDD	10	0.77	0.72	0.83
1,2,3,4,7,8-HxCDF	10	0.97	0.77	1.22
1,2,3,6,7,8-HxCDF	10	0.95	0.66	1.37
1,2,3,7,8,9-HxCDF	2	1.28	0.01	127.42
2,3,4,6,7,8-HxCDF	10	1.37	1.21	1.54
1,2,3,4,6,7,8-HPCDD	10	1.20	1.10	1.30
1,2,3,4,6,7,8-HPCDF	10	0.96	0.72	1.27
1,2,3,4,7,8,9-HPCDF	10	0.81	0.44	1.49
OCDD	10	0.97	0.90	1.03
OCDF	10	0.69	0.50	0.94
Median		0.97		

* Includes only pairs for which both results exceeded their corresponding detection limit

Correction Factor

The second task from Region 2 was to develop, if possible, a correction factor with uncertainty estimates.

Part of the data and information sent to CSC during October and November of 2009 included statistical analyses and graphs prepared by Malcolm Pirnie, Inc. (MPI) at the request of the U.S. Army Corps of Engineers and EPA. Based on line plots, bi-variate plots, and statistical analyses, MPI concluded that there was a systematic bias in results for 2,3,7,8-TCDD, with the results from CAS biased low by approximately a factor of two compared to results from AXYS. The statistical analyses and plots were helpful in understanding the significance of differences in results between CAS and AXYS.

Assumptions in Estimating a Correction Factor

Significant assumptions must be made in order to develop a correction factor. First, a correction factor cannot be estimated without error unless the true values of the PCDDs/PCDFs in the samples are known. However, as with any environmental samples, the true concentrations of PCDDs/PCDFs in the split samples are unknown. Therefore, if a correction factor must be developed, one must assume that the results from one of the two laboratories are closer to the true values.

While it could be argued that concentrations produced by CAS should be assumed to be true values, because neither lab used SDS (i.e., followed Method 1613B explicitly), the 2005/2007 Newark Bay data, and the 2009 Lower Passaic River data, combined with the fact that AXYS produced results that are usually greater than those produced by CAS, leads to a very firm conclusion that the AXYS results are closer to the true values. Otherwise, there would need to be a means by which AXYS was producing an excess of 2,3,7,8-TCDD and the other PCDDs/PCDFs, or there would need to be an inconsistent operation in the analysis, which we could not find.

Second, to prevent the correction factor(s) from being overly affected by a few high or low concentrations, we used the geometric mean of the sample-specific ratios between the CAS and AXYS results for a given congener as the best available means to adjust the CAS data to address the disparity.

We calculated the ratios of the CAS and AXYS results only for those split sample pairs for which both laboratories' results were greater than their corresponding quantitation limits, to assure that the ratios reflect the systematic differences between laboratories' results, rather than a comparison of quantitation limits. As a consequence, the number of ratios used in the geometric mean calculation differed among congeners. Table 4 provides the geometric mean of the CAS-AXYS ratio and the 95% lower and upper confidence limits for results above the quantitation limits for both labs.

Table 4. Geometric Means of 2008 Passaic River CAS/AXYS Ratios and Associated Confidence Intervals

PCDD/PCDF	n*	CAS/AXYS Geometric Mean	Confidence Intervals	
			95% Lower Limit	95% Upper Limit
2,3,7,8-TCDD	19	0.53	0.41	0.69
2,3,7,8-TCDF	21	0.71	0.53	0.95
1,2,3,7,8-PeCDF	3	0.91	0.20	4.13
2,3,4,7,8-PeCDF	6	0.73	0.51	1.05
1,2,3,6,7,8-HxCDD	11	0.69	0.53	0.91
1,2,3,7,8,9-HxCDD	4	0.72	0.65	0.79
1,2,3,4,7,8-HxCDF	18	0.80	0.64	1.00
1,2,3,6,7,8-HxCDF	13	0.81	0.60	1.10
2,3,4,6,7,8-HxCDF	7	0.90	0.58	1.40
1,2,3,4,6,7,8-HPCDD	24	0.78	0.57	1.06
1,2,3,4,6,7,8-HPCDF	21	0.70	0.53	0.91
1,2,3,4,7,8,9-HPCDF	5	0.65	0.31	1.37
OCDD	28	0.71	0.52	0.97
OCDF	21	0.70	0.53	0.93
Median		0.71		

*Includes only pairs for which both results exceeded their corresponding quantitation limit

The individual congener-specific geometric means ranged between 0.53 (2,3,7,8-TCDD) and 0.91 (1,2,3,7,8-PeCDF), with a median geometric mean of 0.71. For seven of the fourteen congeners, the confidence interval did not include 1.0, thus indicating that the bias between laboratories was statistically significant at the 95% confidence level. Although fewer analytes exhibited statistically significant differences then in the 2005-2007 data, their geometric means in the 2008 data are further from 1.0, suggesting that the less frequent statistical significance observed in the 2008 data was a likely effect of the smaller number of paired results.

Table 4 does not include entries for the three congeners that were not consistently reported by both labs in these split samples. Specifically, 1,2,3,7,8-pentachlorodibenzo-*p*-dioxin (PeCDD), 1,2,3,4,7,8-hexachlorodibenzo-*p*-dioxin (HxCDD), and 1,2,3,7,8,9-hexachlorodibenzofuran (HxCDF) were not reported by both laboratories at levels above their respective quantitation limits in the same samples. We made no attempt to evaluate the results for these three congeners because comparing quantitation limits to one another, or comparing positive results and non-detects, would be misleading. However, it is worth noting that for these three congeners, CAS did not report a result above their QL for any samples, while AXYS reported a result above their QL for between 2-10 of the samples per congener.

Application of Correction Factors to the Remainder of CAS 2008 Data set

To be able to apply correction factors to samples other than the split samples in the 2008 CAS data set, certain additional assumptions must be made, above and beyond those made for development of the correction factors themselves. Because there are no split sample data for the vast majority of the 2008 CAS data set, there can be no assumption of true values, and no variability information for the assumed true values. That means that the assumptions for the split samples must be assumed to be true for the rest of the data set, further adjusted by the variability of the rest of the data.

We also considered the appropriateness of adjusting the CAS results using the geometric means. We believe that further information about the spatial distribution would be necessary before such an adjustment should be attempted, and that without split sample results, any such adjustment would be problematic. In particular, the confidence intervals in Table 2 are for the geometric mean itself. To be able to estimate the variability of a corrected (using the geometric mean) value would require estimating the covariance between the CAS and AXYS results, the covariance between the CAS result and the geometric mean, and the variability of an individual CAS result.

Miscellaneous Issues

Conference calls were held with EPA on December 9 and 17, 2009 to discuss CSC's preliminary findings. During the December 9 conference call, a recent paper was discussed, entitled *Formation of Polychlorinated Dibenzo-p-Dioxins during the Extraction of Pentachlorophenol-Contaminated Guar Gum* by Yves Tondeur, Bryan Vining, Allen Martin, Jeremy Morgan, and Jerry Hart presented at the 2009 Dioxin Symposium regarding the formation of certain PCDDs/PCDFs during extraction of samples with solvent systems containing acetone. Concern was expressed that the paper could be misinterpreted to state that the use of acetone by AXYS in the extraction could result in formation of certain PCDDs/PCDFs and could lead to inflated results by AXYS.

We reviewed the Tondeur *et al.* paper in greater depth after the call and believe that the differences between the situation it describes and the Lower Passaic River split samples are significant. First, the reaction requires precursors such as polychlorinated hydroxydiphenylethers, known impurities in pentachlorophenol (PCP) formulations. It is unlikely that these precursors are present in significant quantities in Lower Passaic River sediment, although we do not know for certain that these precursors are not present. Second, the reaction is catalyzed by an acid, such as the PCP that contaminated the guar gum. Unless the Lower Passaic River sediment was contaminated with an acid such as PCP, we would not expect an acid-catalyzed reaction of hydroxydiphenylethers with acetone to form PCDDs/PCDFs. Third, the major reaction products reported by Tondeur *et al.* are certain heptachlorodibenzo-*p*-dioxins (HpCDDs), pentachlorodibenzo-*p*-dioxins (PeCDDs), and octachlorodibenzo-*p*-dioxin (OCDD). 2,3,7,8-TCDD was not detected and is not mentioned in the paper. Fourth, the only congeners of environmental significance are those substituted in the 2, 3, 7, and 8 positions (see the list in Table 2). 1,2,3,7,8-PeCDD and OCDD were the only 2,3,7,8-substituted congeners found by Tondeur *et al.* Last, during the December 17 conference call, Yves Tondeur stated that he did not believe that 2,3,7,8-TCDD would form under the conditions presented in his paper. Given this information, we conclude that 2,3,7,8-TCDD would not be formed by use of acetone in the extraction, and that formation of other PCDDs/PCDFs of environmental significance is highly unlikely.

During the conference call on December 9, 2009, Louis Berger noted that TestAmerica-Knoxville (TAK) analyzed samples for PCB congeners for CPG, and that there were not systematic discrepancies between their results and the splits run for EPA. Following the call, CSC examined the sample chain-of-custody records provided by EPA and determined that AXYS also analyzed these same samples for PCBs. We contacted TAK and learned that TAK uses hexane:acetone (1:1) with no sodium sulfate for extraction of PCBs from soil and sediment (we did not mention the Lower Passaic River project).[1] Because the PCB results from AXYS and TAK were comparable, it would appear that use of acetone as a co-solvent in the extraction may obviate the need for sodium sulfate. Co-solvents using acetone would need to be investigated further if an alternative to baked, powdered, anhydrous sodium sulfate was desired. However, given that baked, powdered, anhydrous sodium sulfate is known to work, and is specified in many environmental analytical methods, including Method 1613B, further effort in this area is, in our opinion, unwarranted.

[1] CSC also learned that TAK uses SDS for extraction of PCDDs/PCDFs from soil and sediment as per Method 1613B for solid matrices, and uses baked, powdered, anhydrous sodium sulfate and Soxhlet extraction per Method 1613B for tissue.

During the conference call on December 17, 2009, a discussion was held regarding a potential plan for reanalysis of the split Lower Passaic River sediment samples archived at AXYS. The samples would be analyzed by SDS to establish concentrations determined by Method 1613B as written. These concentrations would then be assumed to be "correct values" and could be compared to concentrations determined by AXYS and CAS to further learn which concentrations are closest to concentrations determined by Method 1613B. However, in light of the 2005, 2007, and 2009 results that demonstrate that AXYS procedure produces either slightly higher results (13% difference in the 2005/2007 data) or not significantly different results (7% difference in the 2009 data), further analyses of these samples is unwarranted.

Findings and Recommendations

From the information provided, our finding is that one or more modifications of EPA Method 1613B by CAS and AXYS are responsible for the disparities in results between the two laboratories. These modifications are:

- Use of J.T. Baker sodium sulfate by AXYS vs. use of EMD Chemicals sodium sulfate by CAS,
- Use of 75 - 100 g of anhydrous sodium sulfate by AXYS vs. 5 - 10 g by CAS,
- Baking of the sodium sulfate at 325 °C for 8 hours by AXYS, but no baking by CAS,
- Allowing 30 min drying time of the sample/sodium sulfate mixture after addition of sodium sulfate by AXYS, but not by CAS, and/or
- Use of toluene:acetone (80:20) as the extraction solvent by AXYS vs. use of toluene only by CAS.

We believe that the amount of sodium sulfate and the toluene:acetone co-solvent are likely the most significant factors. Specifically, we believe that the use of larger amounts of sodium sulfate by AXYS and use of a toluene:acetone co-solvent resulted in a more complete extraction of PCDDs/PCDFs from the sediment.

Another finding is that, based on the Tondeur *et al.* paper and statements made by Yves Tondeur, there is no evidence that acetone used as an extraction solvent results in formation of PCDDs/PCDFs. Therefore, results by AXYS are not inflated over the true values in the sediment.

Finally, results from the 2005/2007 and 2009 split samples provide ample evidence that AXYS produces results that are sufficiently close to the results produced by SDS that EPA can proceed with application of a correction factor to the 2008 CAS data.

Application of a Correction Factor to the CAS 2008 Lower Passaic River Data

Based on the information in this examination, application of a correction factor to the 2008 data set is appropriate. However, for a correction factor to be applied to these data, we suggest an examination of the spatial distribution of the samples collected for the splits and for the remainder of the 2008 data, and an examination of the error structure of the CAS measurements, to attempt to learn how the error associated with any correction would be affected.

The Effect of Application of a Correction Factor on Chlorinated Dibenzo-*p*-Dioxins and Dibenzofuran Results Produced by Columbia Analytical Services for Lower Passaic River Sediment Samples

Prepared by

Environmental Solutions
6101 Stevenson Avenue
Alexandria, VA 22304

and

Interface, Inc.
P.O. Box 297
Fort Collins, CO 80522

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The Effect of Application of a Correction Factor on Chlorinated Dibenzo-*p*-Dioxins and Dibenzofuran Results Produced by Columbia Analytical Services for Lower Passaic River Sediment Samples

I. Introduction

In October of 2009, Alice Yeh, EPA Region 2, contacted the Office of Water, Engineering and Analysis Division (EAD), Engineering and Analytical Support Branch (EASB) for assistance in finding the reason(s) for disparities in the results between Columbia Analytical Services (CAS) and AXYS Analytical Services (AXYS) for determination of 2,3,7,8-substituted polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (PCDDs/PCDFs) in split sediment samples from studies in the Lower Passaic River in 2008. CAS analyzed the split samples between August 2008 and April 2009 for the Cooperating Parties Group (CPG), representing potentially responsible parties (PRPs). AXYS analyzed the split samples between October 2008 and January 2009 for EPA.

Region 2 requested that EASB help with the following two tasks:

- Attempt to determine a reason or reasons for the systematic bias in the data, and
- If possible and appropriate, provide a correction factor that would allow the full 2008 CAS data set for PCDDs/PCDFs to be adjusted for the disparity.

EPA, along with its contractor, Computer Sciences Corporation (CSC) and their subcontractor, Interface, Inc., performed an assessment of the split data and any supporting documentation and information to complete the above tasks.

From this analysis, it was concluded that both CAS and AXYS made one or more deviations from EPA Method 1613B. These deviations are responsible for the disparities in results between the two laboratories. The ultimate effect of these deviations was a more complete extraction of PCDDs/PCDFs from the sediment by AXYS, compared to CAS.

A potential correction factor was calculated for each PCDD/PCDF by calculating the geometric mean of the individual sample split ratios for all pairs for which both labs yielded results exceeding their QL. By multiplying the PCDD/PCDF CAS results from non-split samples by this factor, the magnitude of the systematic bias in these results would be reduced. However, it was cautioned that the effect of application of a correction factor on the precision of the CAS results, and an examination of how the spatial distribution of the samples collected for the splits may differ from the spatial distribution of the non-split 2008 samples, be performed prior to adjusting any of the data.

In May of 2010, Alice Yeh requested that EASB and CSC complete these suggested assessments. CSC requested documentation on the initial sampling design of the 2008 sample collection, and of the sample splitting, and received this information in August 2010.

The remainder of this report describes CSC's examination of the difference in random variability (i.e., precision) of the corrected CAS PCDD/PCDF results compared to the uncorrected results, and whether the sample splits are representative of the full set of 2008 PCDD/PCDF data.

II. Effect of Correction Factor Application on Random Variability

It has been previously shown that PCDD/PCDF results determined from split samples by CAS as part of the 2008 Lower Passaic River sampling are biased low when compared to those determined by AXYS, based on deviations from method requirements (CSC and Interface, 2010). To minimize the effect of this low bias on the remaining PCDD/PCDF 2008 sample results, it was suggested that a correction factor be

applied. A correction factor for each PCDD/PCDF was calculated as the geometric mean of the ratios between the two labs' results for all sample splits for which both laboratories detected the target analyte above their QL. However, CSC previously advised EPA to be cautious when applying this correction factor, as it is likely that the corrected results, while having less systematic variability, will have larger random variation.

The calculations used to estimate the variability associated with a corrected result are detailed in Appendix 1. These calculations require estimates of the variability and the mean of the correction factors. These estimates were developed in two ways: 1) direct estimation based on the assumption that individual split sample results from across the site are log-normally distributed, and 2) determining robust estimates using Bootstrap estimation. These two methodologies are described in detail in Appendix 2.

Once estimates of the variability associated with corrected results were made, they were compared to the variability of a single uncorrected sample result. Because the variability of the individual CAS results was largely driven by spatial variability (i.e., inherent differences in PCDD/PCDF concentrations across the site), the analytical portion of this total variability was estimated using the 42 field duplicate samples collected at the site. While variability estimates determined using these field duplicate samples would include sampling variability in addition to analytical variability, these data would still yield the most accurate estimate of the variability associated with a single measured result.

Once the variances of an uncorrected and corrected result are estimated, the relative increase in variability occurring for a corrected result can be determined by calculating the ratio of these two estimates. These ratios quantify the increase in variability of a single sample result that would occur if that result was to be adjusted using the correction factor. These ratios were determined by comparing both the variances and standard deviations of corrected and uncorrected results. The results of this assessment, with correction factor variability estimates based on the lognormal assumption and Bootstrap estimation, are shown in Tables 1 and 2, respectively. Additionally, each table shows the correction factor calculated from the sample splits, and the number of duplicate pair results and sample split results used in the calculation. Table 1 also presents the correlation calculated between the log-transformed results of the sample splits for each PCDD/PCDF (used in the lognormal distribution estimation of the correction factor variability, but not in the Bootstrap estimation).

Table 1. Ratios of Standard Deviations and Variances of Corrected to Uncorrected Results, Based on Lognormal Distribution Estimation

PCDD/PCDF	# Splits	# Duplicate Pairs	Correction Factor	Correlation between Split Results	Estimated Increase in Variability of a Corrected Result	
					Std. Dev.	Variance
1,2,3,4,6,7,8-HpCDD	24	32	1.282	0.885	1.504	2.261
1,2,3,4,6,7,8-HpCDF	21	31	1.429	0.886	1.501	2.253
1,2,3,4,7,8,9-HpCDF	5	8	1.538	0.503	3.279	10.751
1,2,3,4,7,8-HxCDF	18	24	1.250	0.920	1.301	1.693
1,2,3,6,7,8-HxCDD	11	12	1.449	0.826	1.653	2.732
1,2,3,6,7,8-HxCDF	13	15	1.235	0.556	1.369	1.874
1,2,3,7,8,9-HxCDD	4	7	1.389	0.997	1.416	2.004
1,2,3,7,8-PeCDF	3	4	1.099	0.937	2.044	4.179
2,3,4,6,7,8-HxCDF	7	10	1.111	0.693	1.324	1.754
2,3,4,7,8-PeCDF	6	8	1.370	0.951	1.991	3.966
2,3,7,8-TCDD	19	33	1.887	0.952	2.126	4.519
2,3,7,8-TCDF	21	30	1.408	0.789	1.561	2.437
OCDD	28	40	1.408	0.872	1.645	2.705
OCDF	21	31	1.429	0.848	1.487	2.213

As can be seen from Table 1, the ratio of the corrected to uncorrected standard deviations tended to be slightly higher than the correction factor for most of the dioxins/furans. This indicates that the variability of a corrected result would be slightly greater than that of an uncorrected result of the same value. For example, if CAS determined a 2,3,7,8-TCDD result of 100 ng/kg, which was adjusted to 188.7 ng/kg using the correction factor, the variability of this corrected result would be slightly larger than that of an uncorrected CAS result of 188.7 ng/kg (i.e., from another sample).

For a few dioxins and furans, the ratio of corrected to uncorrected standard deviations exceeded the correction factor. This tended to occur for analytes for which very few sample splits and/or field duplicate pairs yielded results above the QL, and/or analytes that did not have strong correlations between the two labs' log-transformed results. For example, while the correction factor for 1,2,3,4,7,8,9-HpCDF is 1.538, the standard deviation of a corrected result would be 3.3 times greater than that of an uncorrected result. This was due to both the small number of sample splits (5) and duplicate pairs (8) used in the correction factor calculation, and the relatively weak correlation (r=0.503) observed between the two labs' results for those splits.

Table 2. Ratios of Standard Deviations and Variances of Corrected to Uncorrected Results, Based on Bootstrap Estimation

PCDD/PCDF	# Splits	# Duplicate Pairs	Correction Factor	Estimated Increase in Variability of a Corrected Result	
				Std. Dev.	Variance
1,2,3,4,6,7,8-HpCDD	24	32	1.282	1.404	1.971
1,2,3,4,6,7,8-HpCDF	21	31	1.429	1.457	2.122
1,2,3,4,7,8,9-HpCDF	5	8	1.538	1.665	2.772
1,2,3,4,7,8-HxCDF	18	24	1.250	1.282	1.642
1,2,3,6,7,8-HxCDD	11	12	1.449	1.486	2.208
1,2,3,6,7,8-HxCDF	13	15	1.235	1.248	1.559
1,2,3,7,8,9-HxCDD	4	7	1.389	1.400	1.959
1,2,3,7,8-PeCDF	3	4	1.099	1.100	1.210
2,3,4,6,7,8-HxCDF	7	10	1.111	1.134	1.285
2,3,4,7,8-PeCDF	6	8	1.370	1.435	2.059
2,3,7,8-TCDD	19	33	1.887	1.942	3.771
2,3,7,8-TCDF	21	30	1.408	1.475	2.176
OCDD	28	40	1.408	1.592	2.533
OCDF	21	31	1.429	1.417	2.007

The estimated ratios calculated using the Bootstrap estimation technique were slightly smaller than those determined following the lognormal distribution assumption. For those PCDD/PCDFs with very little data above the QL, the bootstrap-estimated standard deviation ratios were lower than those shown in Table 1.

III. Representativeness of Correction Factor

As stated in the QAPP for CPG Oversight of Lower Passaic River Restoration Project (LPRRP) 2008 Sediment Coring:

> "Under the planned oversight program a total of 30 split sediment samples will be collected judgmentally by on-site oversight personnel from the sediment samples being collected and homogenized by the CPG. The selection of split samples by the oversight personnel will consider factors such the type of sediment and the depth of the segments, as well as the availability of sufficient sample material. A preference will be given to obtaining samples which appear to be potentially contaminated based upon their appearance (color), odor and texture."

Therefore, the sampling locations and samples that were to be split were not randomly selected. As a result, it cannot be assumed that these samples, and the correction factor calculated based on results determined from these samples, are representative of the site as a whole. The statement that preference would be given to samples which appeared to be contaminated implies that on average, sample split results could be higher than those of non-split samples.

Table 3 shows the frequency of non-split and split samples for each of the site areas, as defined in the QAPP for RI Low/Resolution Coring/Sediment Sampling in the LPRRP RI/FS.

Table 3. Frequency of Split and Non-Split Samples by Study Area

	Non-Splits		Splits	
Study Area	Number of Samples	Percent of Samples	Number of Samples	Percent of Samples
Point-no-Point Reach	208	30.9	12	40.0
Harrison Reach	72	10.7	1	3.3
Newark Reach	59	8.8	0	0.0
Kearny Reach	29	4.3	1	3.3
Upstream	41	6.1	6	20.0
Second River	85	12.6	4	13.3
Third River	109	16.2	4	13.3
Saddle River	5	0.7	0	0.0
Above Dundee Dam	35	5.2	2	6.7
Tributaries	30	4.5	0	0.0
Total	673	100	30	100

As can be seen, the frequency of samples being split was generally close across the site, though there was a slightly higher frequency of split samples (i.e., the percent of splits collected in the area exceeded the percent of non-splits that were collected at that area) in the Upstream area, and a lower frequency of split samples (i.e., the percent of splits collected in the area was less than the percent of non-splits that were collected at that area) across the Harrison, Newark and Kearny reaches. These three areas tended to have higher PCDD/PCDF concentrations than other areas of the site.

While the sampling frequency seemed to indicate that the sample split data are not fully representative of the data as a whole, systematic differences in the analytical results were not observed for most dioxins and furans. Table 4 shows the descriptive statistics of all PCDD/PCDF results above the QL for the split and non-split samples. Results of two-sample t-tests comparing the mean log-transformed concentrations of the split and non-split samples, and of F-tests comparing the variance of the log-transformed concentrations of the split and non-split samples also are presented. Both tests were run at the 95% confidence level.

Among the 14 PCDD/PCDFs with results that exceeded the QL, the mean of the split sample results differed significantly from the mean of the non-split sample results for only two furans (2,3,4,6,7,8-HxCDF and 2,3,7,8-TCDF). For 2,3,4,6,7,8-HxCDF, the mean log-transformed concentration was significantly higher for the non-split samples, while for the 2,3,7,8-TCDF, the mean log-transformed concentration was significantly higher for the split samples. The variance of the log-transformed split sample results differed significantly from the variance of the log-transformed non-split results for four furans; in all cases but one (2,3,4,7,8-PeCDF), the variability was higher for the non-split samples.

Figures 1 and 2 show the distribution of 2,3,7,8-TCDD and 2,3,7,8-TCDF for the split and non-split samples, respectively.

Table 4. Comparison of PCDD/PCDF Results for Split and Non-split Samples

PCDD/PCDF	Non-Split Samples [1]					Split Samples [1]					Difference in means? [4]	Difference in Variance? [5]
	# Results > QL	% Results > QL[2]	Mean (ng/kg)	Median (ng/kg)	SD (ng/kg)	# Results > QL	% Results > QL[3]	Mean (ng/kg)	Median (ng/kg)	SD (ng/kg)		
1,2,3,4,6,7,8-HpCDD	534	79.35%	490.07	321.50	576.04	24	80.00%	576.83	499.50	589.83	N (p=0.748)	N (p=0.366)
1,2,3,4,6,7,8-HpCDF	492	73.11%	717.16	373.00	1285.42	21	70.00%	692.59	610.00	640.51	N (p=0.390)	N (p=0.527)
1,2,3,4,7,8,9-HpCDF	82	12.18%	61.74	43.85	51.25	5	16.67%	45.28	46.20	8.45	N (p=0.320)	**Y (p=0.038)**
1,2,3,4,7,8-HxCDF	362	53.79%	233.68	140.50	360.69	18	60.00%	188.34	168.50	144.83	N (p=0.919)	N (p=0.790)
1,2,3,6,7,8-HxCDD	181	26.89%	78.10	57.10	72.96	11	36.67%	80.02	57.30	64.50	N (p=0.774)	N (p=0.985)
1,2,3,6,7,8-HxCDF	209	31.05%	85.64	60.10	90.14	13	43.33%	63.09	62.20	22.62	N (p=0.428)	**Y (p=0.027)**
1,2,3,7,8,9-HxCDD	91	13.52%	53.93	41.90	56.46	4	13.33%	57.53	39.50	47.15	N (p=0.908)	N (p=0.250)
1,2,3,7,8-PeCDF	59	8.77%	65.82	40.00	76.83	3	10.00%	38.87	43.30	10.76	N (p=0.565)	N (p=0.348)
2,3,4,6,7,8-HxCDF	137	20.36%	66.92	49.40	49.70	7	23.33%	41.30	37.40	10.73	**Y (p=0.017)**	**Y (p=0.040)**
2,3,4,7,8-PeCDF	147	21.84%	69.28	53.90	50.07	6	20.00%	199.50	68.30	278.18	N (p=0.224)	**Y (p=0.005)**
2,3,7,8-TCDD	491	72.96%	1718.97	155.00	7978.42	19	63.33%	461.25	223.00	711.27	N (p=0.748)	N (p=0.214)
2,3,7,8-TCDF	506	75.19%	33.78	16.80	50.41	21	70.00%	56.30	23.90	88.90	**Y (p=0.025)**	N (p=0.582)
OCDD	634	94.21%	4853.84	2580.00	7148.75	28	93.33%	5151.00	2405.00	5380.48	N (p=0.600)	N (p=0.879)
OCDF	487	72.36%	1557.90	741.00	3864.91	22	73.33%	1238.81	900.00	1261.26	N (p=0.730)	N (p=0.695)

[1] Descriptive statistics calculated using results above QL only.
[2] Compared to 673 total non-split samples.
[3] Compared to 30 total split samples.
[3] Based on two-sample t-tests performed based on log-transformed results (α=0.05). Satterthwaite degree of freedom correction applied if variances differed significantly. Significant differences indicated with bold font.
[4] Based on F-test performed based on log-transformed results (α=0.05). Significant differences indicated with bolt font.

Generally, there seems to be little systematic difference in mean concentration between the dioxin and furan results determined from split samples and those determined from non-split samples. For example, the median of the log-transformed 2,3,7,8-TCDD concentrations (approximately equal to the mean log-transformed concentrations, due to the symmetric distribution) for the split and non-split samples were very close, as shown by the red horizontal lines in Figure 1A. Significant differences in mean concentration between split and non-split samples only were observed for two furans, including 2,3,7,8-TCDF as can be seen in Figure 1B, The larger frequency of significant differences in variability between the split and non-split samples is not surprising. Only 30 of the 673 samples collected were splits, and the much larger number of non-split samples would be expected to yield greater variability because more sources of variance would be included in those samples than in the splits. This variability difference could indicate that the correction factor determined from split samples may not be representative of samples with results at the upper or lower end of the distribution (though results below the QL would not necessarily be corrected).

Figure 1. Distribution of 2,3,7,8-TCDD for Split and Non-split Samples

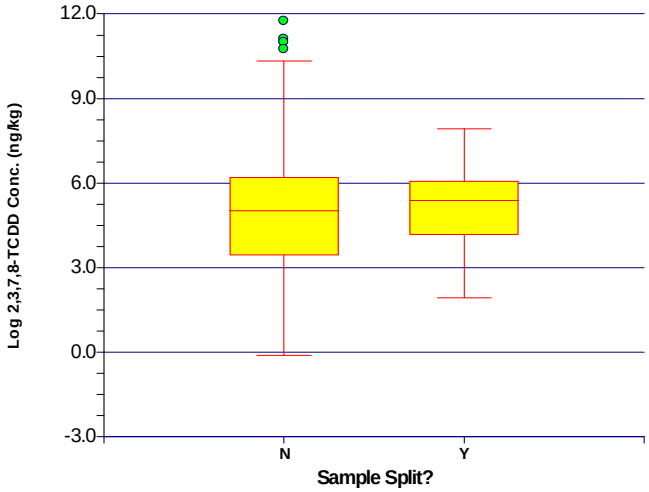
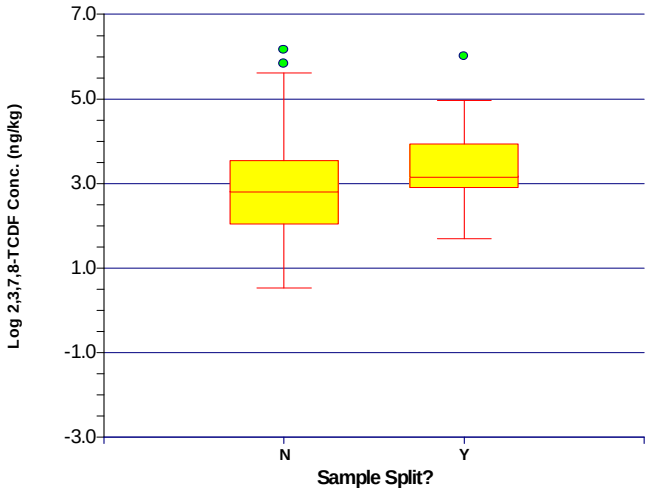


Figure 2. Distribution of 2,3,7,8-TCDF for Split and Non-split Samples



While the results of the comparisons described above varied between analytes, it is worth noting that the question of representativeness is ultimately one of sample design, and therefore would be true of all analytes or of no analytes. Additionally, performing separate comparisons for the relatively large number of dioxins and furans would increase the probability of at least one analyte yielding a false positive conclusion, i.e., that a significant difference exists between the split and non-split samples when in fact there is none. To protect against this inflated probability, the mean and variance comparisons presented in Table 4 were performed again, using the Bonferroni adjustment, which adjusts the significance level of individual comparisons such that the overall probability of concluding that any analytes within an analyte group differed significantly between split and non-split samples was 5%. For the purpose of this analysis, the first analyte group was defined to be dioxins (i.e., the 5 analytes with results exceeding the QL for both split and non-split samples), and the second group was defined to be furans (i.e., the 9 analytes with results exceeding the QL for both split and non-split samples). The analytes that did not exceed the QL were not evaluated in this assessment. When the Bonferroni adjustment was used, the mean concentrations of split and non-split samples did not differ significantly for any analyte within the two groups, and the variances of split and non-split samples differed significantly for only one furan (2,3,4,7,8-PeCDF).

Whether the comparison results with the Bonferroni adjustment are more valid than the unadjusted comparison results depends on how the decision regarding the correction factor would be made. If EPA decides that the correction factor will be applied to some analytes and not others, than the unadjusted analyses would be more appropriate. If EPA decides that the correction factor will be applied to either all analytes or no analytes, than the adjusted analysis results would be preferable. However, given the relatively infrequent occurrence of significant differences, and the tendency for significant differences to occur for analytes with fewer detects above the QL (for example, the four furans for which the variability differed significantly between split and non-split samples were not detected above the QL for the majority of samples), it is unlikely that the Bonferroni adjustment would have a strong effect on the ultimate decision.

IV. Conclusions

The systematic difference between PCDD/PCDF concentrations determined by CAS and those determined by AXYS indicates that a systematic correction of results determined by CAS may be warranted. Using the geometric mean of the ratios calculated across split samples as a correction factor would decrease the bias of the CAS-determined results for non-split samples. However, applying this factor could have a detrimental effect on the usability of the data if the corrected results have much larger variances associated with them than the uncorrected variances, or if the correction factors are based on a subset of samples that are not representative of the dataset as a whole.

An assessment of the variability of the correction factors and the uncorrected results indicates that while the variability associated with a corrected result is larger than that of an uncorrected result, that increase would only be slight compared to an uncorrected result without the low bias. The only exceptions to this are for PCDD/PCDFs for which the correction factors were based on a small number of splits, due to the low frequency of detection above the QL. Therefore it does not appear that application of the correction factor will seriously decrease the precision of the data for most PCDD/PCDFs.

The choice of samples to be split and sent to the additional laboratory was made on a systematic, rather than random, basis. One of the factors in this selection was to prioritize samples that appeared to be contaminated based on visual inspection. This could potentially yield correction factors that were calculated from samples with higher concentrations than those samples to which the factor would be applied. However, there was little evidence of this in the data. In general, the frequency of samples

chosen for splitting across the various areas of the site did not seem to differ notably from the overall sampling frequency. Additionally, a statistically significant difference in the mean concentration was not observed between split and non-split samples for most PCDD/PCDFs. Differences in variability were observed for some of the furans, which may indicate that the split data and the resulting correction factors may not be representative of results on the upper and lower ends of the distribution. However, the large number of analytes can inflate the probability of falsely concluding that a difference between split and non-split samples exists. If the Bonferroni adjustment is used to hold the probability of falsely concluding a difference occurs for any analytes within a group (i.e., dioxins or furans) to 5%, a difference in variability is only observed for one furan. However, the significant differences in variability that were observed when the adjustment was not made tended to occur for analytes with infrequent detects. As a result, the Bonferroni adjustment should not have a strong effect on the ultimate decision of whether to apply the correction factor to the data.

As a whole, the issues surrounding application of the correction factor appear to be outweighed by the decrease in bias achieved by applying this factor. This is especially true for 2,3,7,8-TCDD, the analyte with the largest systematic difference observed in the split samples. Based on this assessment, the observations regarding method deviations described in CSC's previously submitted review, and the relative consistency of the biases observed across the various dioxins and furans, it is recommended that the correction factors be applied to the 2008 CAS PCDD/PCDF data.

If the correction factors are to be applied, the following are recommended:

- The correction factor should not be applied to results below the CAS QL, because laboratory differences for these results would be due to a sensitivity difference rather than a relative bias. This would also limit the effect of any representativeness issues regarding the correction factor, as differences between the split and non-split samples tended to occur for analytes with few detects.

- Rather than applying the correction factor to the CAS results for the sample splits, the original AXYS results from these samples should be used to avoid the variability increase occurring due to the correction factor application.

V. References

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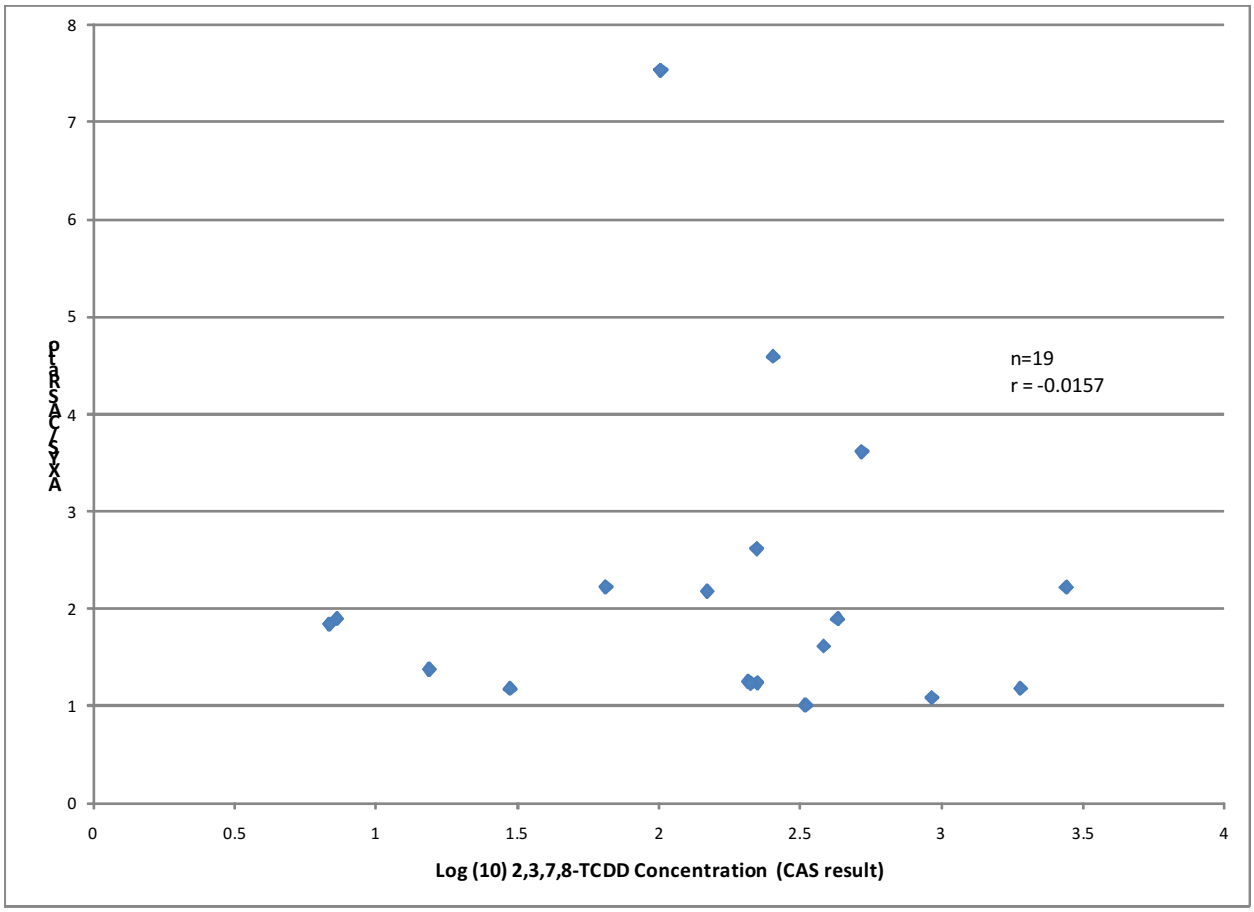
Appendix 1: Estimating the Variance of a Corrected Value using the Delta Method Approximation

Let C_i be a PCDD/PCDF result from CAS, and let CF be the correction factor that will be used to adjust that result.

The approach to estimating the variability of a corrected estimate would depend on whether the correction factor is correlated with the individual CAS sample results. Generally, the larger this correlation is, the greater the estimated variability of the corrected values. However, the ratio of AXYS to CAS results did not tend to increase with increasing CAS concentration (i.e., the ratio itself did not vary systematically with CAS concentration), and in some cases decreased slightly with increasing CAS concentration. For example, Figure 3 is a scatterplot of the 2,3,7,8-TCDD CAS results vs. the calculated AXYS/CAS ratio for that pair.

Figure 3. 2,3,7,8-TCDD CAS result for Sample Splits Compared to AXYS/ CAS Ratio



Because of this lack of an association, the covariance between the correction factor and a sample result could conservatively be set to 0. Therefore, the variance of a corrected result can be estimated directly (Stuart and Ord, 2009), using the formula below:

$$Var(Z) = Var(X)(E[Y])^2 + Var(Y)(E[X])^2 + Var(X)Var(Y)$$

Replacing the general terms X and Y with C, the function of PCDD/PCDF results from CAS, and CF, the correction factor calculated as the geometric mean of ratios of sample splits:

$$Var(Z) = Var(C)(E[CF])^2 + Var(CF)(E[C])^2 + Var(CF)Var(C)$$

The mean of the CAS results can be estimated directly from the sample splits for each dioxin and furan. Because the variance over the CAS results will be driven largely by the inherent spatial variability of PCDD/PCDF concentration across the site, the variance of a single CAS result was estimated using the field duplicate pairs collected at the site and analyzed by CAS. The variance component attributable to duplicate variability (i.e., excluding all spatial and temporal variability) was estimated using variance component analysis based on Restricted Maximum Likelihood estimation (Hemmerle and Hartley, 1973), and was adjusted to estimate the variability of an individual result based on the formula below:

$$Var(C) = \left(1 + \frac{1}{n_{dup}}\right) s^2_{dup}$$

Where s^2_{dup} is the variance component attributable to duplicate variability, and

n_{dup} is the number of duplicate pairs exceeding the ML for the given PCDD/PCDF.

The expected value and variance of the correction factors can be estimated following the derived formulas shown in Appendix 2.

The relative increase in variability that the correction factor application would yield can be estimated using the ratio of the corrected to the uncorrected result:

$$Ratio = \frac{Var(Z)}{Var(C)}$$

The relative increase in standard deviation equals the square root of the above ratio.

Appendix 2: Estimating the Mean and Variance of the Correction Factor Determined from Sample Splits

Approach 1 – Properties of the Lognormal Distribution

The correction factor for each PCDD/PCDF is calculated using the formula:

$$CF = \prod_{i=1}^{n} \left(\frac{A_i}{C_i}\right)^{1/n}$$

where A_i and C_i are the AXYS and CAS results, respectively, for sample split i.

Using the properties of logarithms, this can be restated as:

$$CF = \exp\left[\frac{1}{n}\sum_{i=1}^{n} \log\left(\frac{Ai}{Ci}\right)\right]$$

$$= \exp\left[\frac{1}{n}\left[\sum_{i=1}^{n} \log(Ai) - \log(Ci)\right]\right]$$

$$= \exp\left[\left[\frac{1}{n}\sum_{i=1}^{n} \log(Ai)\right] - \left[\frac{1}{n}\sum_{i=1}^{n} \log(Ci)\right]\right]$$

If we let $LA_i = LN(A_i)$ and $LC_i = LN(C_i)$, and $\overline{LA}$ and $\overline{LC}$ are the calculated sample means of the log-transformed AXYS and CAS results, respectively, then the equation for CF becomes:

$$CF = \exp[\overline{LA} - \overline{LC}]$$

If the individual dioxin and furan results obtained by the two laboratories are each lognormally distributed (i.e., if the LA are normally distributed with mean μ_1 and variance σ_1^2 and the LC are normally distributed with mean μ_2 and variance σ_2^2), then

$\overline{LA} \sim N(\mu_1, \sigma_1^2/n)$

$\overline{LC} \sim N(\mu_2, \sigma_2^2/n)$

The above equations assume that the individual A_i and C_i results are independent of each other (i.e., the individual split sample results determined by AXYS are all independent of each other, and the individual split sample results determined by CAS are all independent of each other). Most of the split sampling locations were widely distant from other split sample locations. However, independence may not be true for all of the samples because, in a few cases, the samples represent different depths at the same location, or at proximal (nearby) locations. Despite the few exceptions, any covariance among the split results within either laboratory should be small, and therefore any impact of the assumption of independence would be small.

Therefore,

$\overline{LA} - \overline{LC} \sim N(\mu_1 - \mu_2, \sigma_1^2/n + \sigma_2^2/n - 2\rho\,\sigma_1\,\sigma_2/n)$, where ρ is the correlation between $\overline{LA}$ and $\overline{LC}$.

Therefore,

$E[CF]=\exp[(\mu_1-\mu_2)+0.5*(\sigma_1^2/n+\sigma_2^2/n-2\rho\sigma_1\sigma_2/n)]$

$Var[CF]=\exp[2*[(\mu_1-\mu_2)+(\sigma_1^2/n+\sigma_2^2/n-2\rho\sigma_1\sigma_2/n)]]-\exp[[2*(\mu_1-\mu_2)]+(\sigma_1^2/n+\sigma_2^2/n-2\rho\sigma_1\sigma_2/n)]$

Approach 2 – Bootstrap Estimation Technique

While the distribution of most PCDD/PCDFs tended to be approximately lognormal, the correction factor mean and standard deviation can be estimated using a resampling technique that does not make this distributional assumption. The specific technique used in this analysis is the Bootstrap estimation technique (Davison and Hinckley, 1997).

The Bootstrap estimates were determined by simulating 1,000 sets geometric means for each PCDD/PCDF. For each set, 30 split pair results were selected with replacement from the set of split results that exceeded the QL for that analyte. The mean of the correction factors, E[CF], was calculated as the mean of the 1,000 simulated geometric means. The correction factor variance, Var[CF], was calculated as the variance of the 1,000 simulated geometric means.